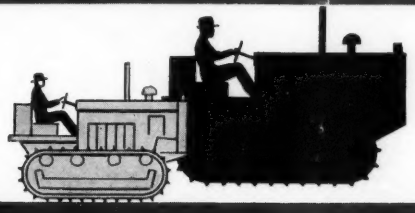
CALIFORNIA

OIL WORLD

and Petroleum Industry

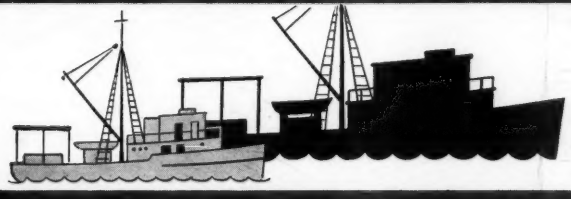
FEB 18 1942

Longer Hauls BETWEEN OVERHAULS

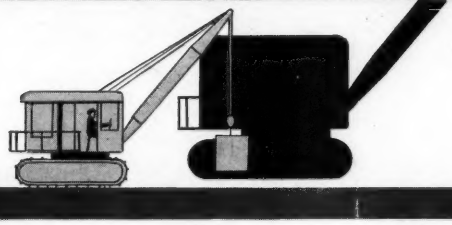


ENGINE LIFE DOUBLED

3 TIMES FARTHER BETWEEN PISTON INSPECTIONS



TWICE AS LONG BETWEEN OVERHAULS



OPERATING EFFICIENCY HOISTED 100%

Want to make *your* Diesels record-breaking performers like the above? Then switch to RPM DELO! It has made these records possible—and many more—adding up to *longer hauls between overhauls* for Diesel operators everywhere. And it's relied on by the U. S. Navy for vital Diesel lubrication jobs. Rely on RPM DELO to stop ring-sticking, end carbon and sludge trouble and cut wear in *any* Diesel, regardless of make, size or type!

Get top power with

STANDARD DIESEL FUEL

Made absolutely clean—*delivered* absolutely clean—100% distilled Standard Diesel Fuel gets every ounce of power out of any Diesel. It lengthens fuel pump and injector life, too—insist on it!

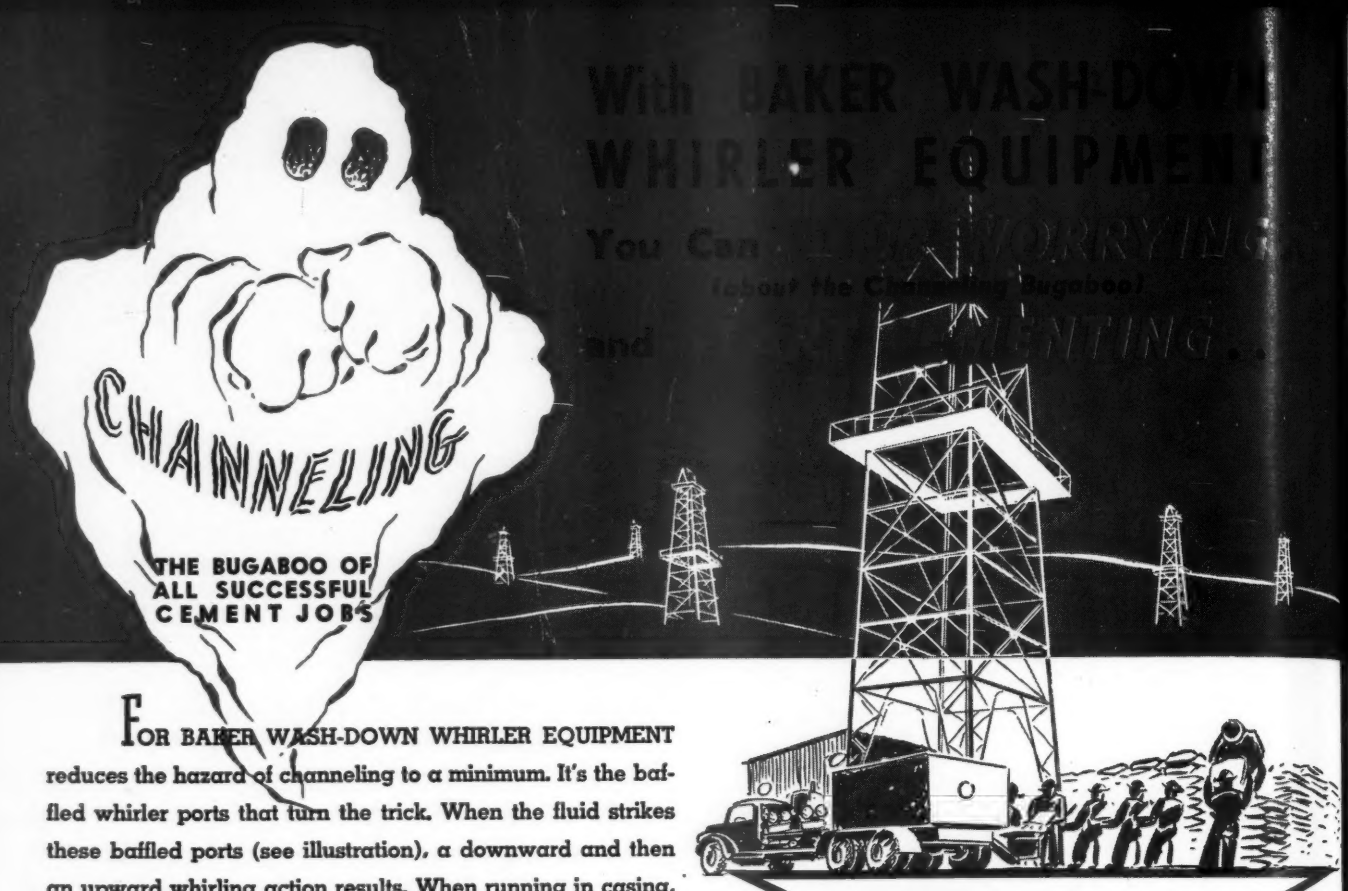
RPM DELO

REG. TRADE-MARK

DIESEL ENGINE LUBRICATING OIL

STANDARD OIL COMPANY OF CALIFORNIA

Vol. 35
No. 3
Whole
No. 1602



FOR BAKER WASH-DOWN WHIRLER EQUIPMENT reduces the hazard of channeling to a minimum. It's the baffled whirler ports that turn the trick. When the fluid strikes these baffled ports (see illustration), a downward and then an upward whirling action results. When running in casing, this whirling action provides a means of disintegrating and washing away bridges. When cementing, the whirling motion, imparted first to the fluid preceding the slurry and then to the slurry itself, washes the formation and properly prepares the hole. It then assures best possible distribution of a uniform body of cement around the shoe and the shoe joint. It is this uniform cement distribution that reduces the hazard of channeling to a minimum, and often saves a costly recement job.

BAKER OIL TOOLS, INC.

MAIN OFFICE AND FACTORY: 6000 South Boyle Avenue
P. O. Box 127, Vernon Station, Los Angeles, Calif.
CENTRAL DIVISION OFFICE AND FACTORY:
6023 Navigation Boulevard, P. O. Box 3048, Houston, Texas
EXPORT SALES OFFICE: 19 Rector Street, New York, N. Y.

BAKER CEMENT GUIDING, FLOATING, CEMENTING EQUIPMENT

GET THE FACTS

If you are not fully acquainted with Baker Wash-Down Whirler Equipment and the remarkable results operators are securing with it... *get the facts today.*

For more information, see page 227 of the 1942 Baker (or Composite) Catalog, or contact nearest Baker office or field representative.

Product No. 120

Quick FACTS
You Should Know About the BAKER CEMENT Wash-Down WHIRLER *Float Shoe

It Provides...

(1) Safe Guiding and Floating
(2) Efficient Washing Action
(3) Positive Acting BALL-TYPE Back-Pressure Valve
(4) Cementing Efficiency
(5) Easy Drillability

* *The Baker Wash-Down Whirler principle is also available in a Guide Shoe.*

Baker Cement Float Shoe
Baker Cement Float Collar
Product No. 100
Product No. 101 M&F
Baker Cement Guide Casing Shoe
Product No. 102
Baker Cement Wash-Down Whirler Float Shoe
Product No. 120
Baker Cement Wash-Down Whirler Guide Shoe
Product No. 121
Baker Cement Whirler Float Collar with Solid Bottom Baffle with Metal "Petal" Basket
Product No. 306

CALIFORNIA
OIL WORLD
and Petroleum Industry

PUBLISHED TWICE A MONTH — ENGINEERING — TECHNOLOGY — LATEST NEWS

FIRST ISSUE
FEBRUARY 1942
VOL. 35 NO. 3
WHOLE NO. 1602

IN THIS ISSUE

Then Came Pearl Harbor—A Fantasy 3

Well Spacing, War, and Geology 6

Generation of Steam As a Factor in Modern Refinery Heat Economy....10

Los Angeles Basin Development 16

San Joaquin Valley Development 20

Coastal District Development 24

Crude Allocations Difficulties with Washington Loom.....25

Germany's Supply Position 27

Business Directory 32

PETROLEUM PUBLISHERS, INC. 939 SO. BROADWAY BLDG.
LOS ANGELES, CALIFORNIA-MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS

WALTER C. MONROE	President and Editor	VICTOR W. HEINZERLING	Assoc.-Editor
KINZIE MILLER	Vice President	DAVIS E. BROWNE	Secty.-Treas.
R. C. CONINE	Managing-Editor	L. O. MILLER	Advertising Manager

R. N. RICHEY, Manager California Oil World News Service and California Oil World Reference Edition

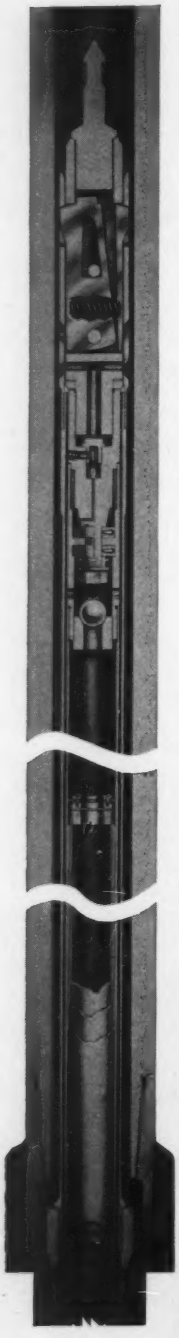
California Oil World and Petroleum Industry is published twice a month at 1009 in the 939 So. Broadway Bldg., Los Angeles, California. Entered as Second-class Matter January 1, 1937, at the post office at Los Angeles, California, under the Act of March 3, 1879. Subscription price $1 per year in U. S. and Possessions, $2 in foreign countries, including Canada. Member of the Audit Bureau of Circulations.

February 11, 1942

Telephone Number TUcker 2571

Announcing

A NEW JOHNSTON SERVICE FOR CALIFORNIA OPERATORS! THE SOLL CORE BARREL!*



EXCLUSIVE FEATURES INCREASE RECOVERY

SOLL CORE BARRELS have set an enviable record for higher core recovery under the toughest conditions. The exclusive telescopic barrel feature, which permits continued entrance of core **even though preceding core material sticks in the barrel** has enabled the SOLL BARRELS to establish an outstanding core-recovery record in all types of formations. More detailed information concerning this equipment—or on Johnston service—will gladly be supplied on request.

Exclusive export rights to the SOLL CORE BARREL are held by M. O. Johnston Oil Field Service Corp.

AS an important supplementary service to its well-known formation and casing testing equipment, M. O. Johnston Oil Field Service Corporation has acquired the sales and service of the famous SOLL CORE BARREL. Effective February 1, 1942, SOLL BARRELS are now available through Johnston's main Los Angeles office, as well as through conveniently-located district stores at Bakersfield, Ventura and Santa Maria.

All sizes, and both the stem and wire-line types of SOLL CORE BARRELS are carried in stock at the various district stores and are available for immediate delivery 24-hours a day. This new service is a convenient supplement to Johnston Formation Testing, since tests are usually made following the coring of possible oil zones. It enables Johnston to offer an even more complete service with which to assist operators in the best possible development of their wells.

***The Soll Core Barrel Company of Compton, California, will continue to manufacture SOLL BARRELS, and all equipment in service will remain their property.**

Then Came Pearl Harbor

—A Fantasy

In the spring of 1917 this country found itself unwillingly plunged into a great World War. Caught short of armaments, the government deemed it advisable to turn practically the entire steel making industry to the task of making the implements of war. This, of course, necessitated strict rationing of steel to all private enterprises including the comparatively young and healthy oil industry. Many regulatory measures were put into effect to conserve the precious steel of which one group dealt with the drilling of oil wells. These measures, hastily drawn up in the nation's capital by sincere and well meaning theorists, failed to consider some of the fundamental principles upon which the oil industry must operate. The authors didn't know or forgot that oil fields vary widely in practically all characteristics. They didn't consider the tremendous differences in thickness of oil bearing formations in different fields nor did they worry much about the wide range of porosity and permeability in reservoir rocks. It probably didn't occur to them that oil is where you find it: that sometimes it is found beneath vast ranches of thousands of acres extent while at other times it underlies areas subdivided into town lots. There was a lot of other things, too, that they didn't give much thought to. All they really sought was the necessary conservation of steel.

They knew that, generally speaking, a certain amount of development should continue to maintain the rate of oil production necessary to keep the war effort provided with fuel and lubricants and they knew, too, that new reserves should be discovered. So they said that new wells could be drilled on a one-to-forty acre basis and they said that exploratory wells could be drilled, defining an exploratory well as one at least two miles from production. This seemed reasonable to the administrators in the capital and even met with approval from operators in some parts of the country. To make everyone feel better, the program was also blessed with the title of an Oil Conservation Plan. Realizing vaguely that it might not be completely perfect, the authors provided that exceptions might be made to the arbitrary regulations, that is, if the operator asking for the exception was gifted with the tenacity of a leech and the patience of Job, plus a knack for unravelling red tape.

The plan was put in operation and it worked. Anyway it conserved oil. There was enough for the war machine, not yet completely motorized, and enough for industry because coal was almost universally used as fuel. There was even enough left over so that a few, very few, important people could occasionally operate their high and formidable looking automobiles. A year and a half went by and the war was won, with the steel withheld from the oil industry doubtless a contributing factor. As it was a short war, the petroleum supply held out, very few people noticing that production had dropped ten per cent despite the drilling and completion of a few wells here and there.

After the signing of the Armistice, the administrative offices governing the oil industry were peopled with a great many fine and sincere young men making a good living. Looking ahead these young men saw a possible let-down in industry after the war boom. To them this meant two things, first, a probable decrease in the demand for crude oil with a resulting need for continued "conservation" and, second, a possible loss of comfortable jobs in case the first point could not be put across and the war time regulations were abandoned. The second consideration was, of course, entirely subconscious and was never spoken of. Knowing that members of Congress love to roll the phrase "conservation of natural resources" off their tongues at election time, our sincere young friends laid the oil industry at the feet of the legislative bodies which within a short time wrote the war time regulations into the law of the land despite protests of oil men.

APOLOGY

We do not believe fiction has much, if any, place in a trade publication. But like a lot of other people these days we're more than a little confused. In the midst of our confusion several ideas occurred to us. We didn't know just what to do with them so we wrote a little story around some of them.

Don't get us wrong, we're not raising a squawk about anything and we're not pointing the finger at anything or anybody. We believe that every effort should be exerted toward defeating our enemies and if every effort legitimately includes a ban on the drilling of oil wells, it's all right with us.

Here is a summary of some of the factors to be considered as we see them. We believe that although the more than 20,000 producing wells in California carry a potential production on paper of 3,700,000 bbls. daily, reasonable production practice would not allow them a total sustained rate of more than 900,000 bbls. daily. Maybe much less. It has required the drilling of approximately 3500 wells during the past three years to **maintain** this figure. With consumption averaging nearly 650,000 bbls. a day there isn't too great a margin of safety, leading us to believe that some drilling would be advisable as part of the war effort. In only a few instances can this be done under the one well to forty acre rule. The multiple zone fields of this state cannot be adequately or economically developed under this plan. And, although no one doubts the necessity of finding new fields, the forty acre rule is a very discouraging factor for the wildcatter to contend with.

We're not raising a squawk. If steel is at present too precious to allocate to the oil industry it's all right with us. We just dont want the subject dismissed too hastily. We apologize for the fiction and promise to leave that to Saturday Evening Post in the future.

This was to protect the industry from itself.

Changing the locale of our story to California, let us look into the general situation and turn of events from 1917 to the present. Prior to 1917, 37 oil fields had been discovered and produced, their combined production for the year 1916 totalling 91,800,000 barrels. During the year 1917 production was increased to 97,268,000 barrels, and two new fields were discovered. One of these new fields proved of no real consequence, the other, Montebello, was of gusher proportions.

Because most of the productive area of Montebello was held by large companies in big leases, as many as four wells were drilled in 1917 on the one-to-forty basis. This added about 250,000 barrels to the total production of the state for the year whereas if drilling had been unrestricted we know the field's output would have been 789,635 barrels. Although the field was later found to contain several separate pools, only 41 wells were drilled because its areal extent was 1,658 acres.

History records no new field discoveries for the year 1918, but the following year, Standard Oil Co., drilling an immense block of acreage, found production in the West Elk Hills area but very little development ensued. Of more significance, however, were certain goings on within the Union Oil Co. Union's geologists had two pet plays which they strongly recommended for drilling. They took maps and circled one area at the intersection of Telegraph Road and the Santa Fe Railroad tracks south of Whittier and another area just north of Atwood Station at the mouth of Santa Ana Canyon in Orange county. These maps they gave to the lease men with instructions to block both areas solid. After months of work, the weary lease men returned the pretty maps to the geologists with the simple statement that it couldn't be done. And it couldn't because each owner of from half an acre to as much as 40 acres had sat down with a pencil and a piece of paper and figured just how much his part of the royalty would be on a one-to-forty basis if oil were discovered. Only in a few cases did the answer come out in the affirmative so the lease hounds had to give it up as a bad job. Kind of too bad because if Union had been allowed to drill under the old "wasteful system" Santa Fe Springs would have produced to the present time 485,000,000 barrels of high grade crude oil and Richfield would have contributed almost 95,000,000 barrels. And these fields would not have been exhausted yet either; they would have been producing at daily rates of 20,000 barrels and 7,000 barrels respectively.

The year 1920 was uneventful with most operators unable to either acquire wildcat acreage in sufficiently large blocks to justify drilling or to drill more wells on their proved lands because of the one-to-forty restriction. Only exception was Standard Oil Co. which found the east end of the great Elk Hills structure productive and managed to get together a large block of acreage adjoining the city of Huntington Beach where production was also obtained. In the latter field, early drilling showed the greater portion of the productive area to be within the limits of the subdivisions of the city where it was impossible to get as many as 80 land owners to join in a community lease to get only one well so development died after six wells. This was a pity too because this field would eventually have covered 2,100 acres and would have produced so far, 310,000,000 barrels of oil and would today be capable of producing 30,000 barrels daily.

In 1921, after making the most careful studies, Shell Oil Co. decided to take a long gamble on Signal Hill because enough acreage could be blocked up on the north and east slopes to drill half a dozen wells if the first should prove successful. By this time curtailed drilling had forced the price of crude oil away above the $2.00 per barrel which it would have been, so Shell shot the works—and found a field. As the wells here were unusually good, landowners adjoining Shell's leases gradually formed associations pooling their townlots into community leases of 40 acres, thus if there were only 100 individual landowners to a well and the royalty was the customary one-sixth, a continuously flowing 1000 barrel well would average $50.00 a month apiece. It took years to get these community leases together but eventually it was done and the 1600 acre areal extent of the field was fully developed with 40 wells. It was found that the productive formations are at least 8000 feet thick so the 40 producing wells were deepened from time to time enabling them to maintain an average of 1000 barrels a day each. As their average age is 10 years, they have produced a total of 146,000,000 barrels. Of course, had normal development taken place the field would now be producing only 38,000 barrels a day. But it would also have produced to date 665,000,000 barrels and contributed mightily toward keeping the price of petroleum products at a point where everyone who wanted a car could have one and afford to run it.

In 1923, Union Oil Co. found the Dominguez field which proved large enough for 26 wells and the Santa Fe Railroad opened the Torrance field. The Railroad, through its operating unit, Chanslor-Canfield Midway Oil Co., had leases enough to drill about 10 wells and a couple of other operators got in for a well or two, but the yields were small and land owners were reluctant to go into large community leases for the small returns promised. Had competitive drilling been allowed, the field would have covered more than 5000 acres and would have produced to date well over 100,000,000 barrels of oil.

In 1924, Union Oil Co. endeavored to get sufficient leases together to justify a test of the area west of Main St. between Rose-

crans Ave. and Athens but found the situation impossible and another major field went undiscovered. The same year, however, Standard Oil Co. found shallow production at Baldwin Hills north of the city of Inglewood. Production at Inglewood in the intervening years was consistent but small in comparison to the 130,000,000 barrels which the field would have yielded under former development practices.

Skipping a ten year period during which history repeated itself again and again, in the year 1936, General Petroleum Corp. became satisfied that a prolific field existed in the area surrounding the Ford Motor Co. plant at Wilmington. All attempts to block up the required amount of acreage failed and a potential billion barrel field still lies undiscovered.

Other areas of the state fared somewhat better than the Los Angeles Basin. In the San Joaquin Valley, Kettleman Hills, Ten Section, Paloma, Coles Levee, the Coalinga Eocene fields and several other fields where the land could be solidly blocked were discovered. But practically all the new fields were found by the major companies and the whole program resulted in the virtual elimination of the independent operator from the oil business. California's annual production remained close to the 1917 figure of 97,268,000 barrels capacity yield instead of the 225,000,000 barrels curtailed flow that it might have been. Proved reserves were less than half the 3,500,000,000 barrels they should have been. As the existing independent refiners were unable to maintain adequate supplies of crude, they too gradually passed from the picture leaving the entire industry in the hands of a few big companies.

Meanwhile, the public, unable to obtain gasoline at reasonable prices, was weaned away from the motor car. Because of the expense of operation, automobiles were used only when essential in business and by the wealthy. This curtailment in public use throttled the automobile industry which in 1917 had shown promise of becoming the largest manufacturing business in the history of the world.

Now this situation was not to the liking of the oil industry and the men composing it did not take it lying down either. Through the years many attempts were made to remove or relax the old war time restrictions, but each was defeated in the name of conservation or on the ground that anything that the industry itself wanted was probably bad on general principles. With the outbreak of World War II, prospects for changes in the law improved, but, a Democracy being what it is, nothing was done except the drawing up of some theoretical plans in the Capital. These plans were predicated on the premise of an Atlantic war and were apparently based on conditions prevailing in Mid-Continent fields.

Then came Pearl Harbor.

Stepping Up Output of Aviation Gasoline

Construction of two Government-owned plants for the manufacture of 100-octane aviation gasoline—the first of their kind—has been recommended by the Office of Petroleum Coordinator. Contracts signed by Defense Supplies Corporation will result in an 11 per cent reduction in the average price paid during the first 6 months of 1941.

The announcement states: "The plants will be wholly financed by the Defense Plant Corp., and will be operated for the Government by the Pure Oil Co. and the Southern Petroleum Co. Negotiations with these companies were conducted by the Office of Petroleum Coordinator.

"Specific quantities of 100-octane gasoline to be produced by each, and the location of the plants, cannot be disclosed for security reasons, but they would add several thousands of barrels to the daily national output of this super-fuel.

"Coordinator Ickes strongly urged several weeks ago that, in addition to encouraging private expansion of 100-octane manufacture, the Government, itself, undertake a program of plant construction in order to speed up production for our flying forces and those of our Allies.

"Concerning this latest development, Deputy Coordinator Ralph K. Davies said: 'The Office of Petroleum Coordinator believes that, wherever possible, private capital should do the job. But, time is so precious, and the need for 100-octane aviation gasoline is so great that some Government construction is imperative. We are glad, therefore, to be able to announce that the first of these plants have now been recommended for final approval. Every barrel of 100-octane they produce will help speed by just so much the defeat of our enemies.'

"Notable progress in the negotiation of contracts under which the petroleum industry will furnish additional quantities of 100-octane aviation gasoline was announced, meanwhile, by Mr. Davies.

"He disclosed that the contracts signed by Defense Supplies Corp. last week with Standard Oil Co. of New Jersey and Magnolia Petroleum Co., confirming arrangements made with the companies by the Office of Petroleum Co-ordinator, will enable Government purchases of 100-octane gasoline at a price more than 11 percent lower than the average price paid for that fuel during the last six months of 1941. The total saving to the Government on these contracts, alone, will amount to several million dollars during the emergency, Mr. Davies said.

"He also stated that a number of other oil companies had accepted the principles of the contracts signed with Jersey and Magnolia. The Texas Co. has already executed three contracts and Mr. Davies said that Sun Oil Co., Sinclair Refining and Richfield Oil Co.—all of which are proceeding with new plant construction—would offer such contracts to the Government within the next few days."

The following was released by the

(Continued on Page 26)

Well Spacing, War, and Geology

C.N.G.A.
Feb. Meeting

William W. Porter II
Consulting Geologist
Los Angeles, California

If southern Californians should design an overcoat suitable for themselves, and then, as a measure to conserve wool, urge this light weight overcoat on the nation as a whole, it would be no more ludicrous than urging the philosophy of eastern oilfield practice upon California. California geology is as different from eastern geology as California climate is different from eastern climate. And a Mid-Continent well spacing plan is as unsatisfactory when superimposed upon California geology as a California overcoat is unsatisfactory for a Mid-Continent winter.

The oilfields of California are in a mobile strip of the earth's crust in the "Pacific circle of fire" which rings the Pacific from the volcanos of Chile and Peru via California and the Aleutian Islands to the volcanos of the Dutch East Indies. This mobile strip of the earth has been subjected to far more structural activity than the areas of the eastern oil fields. Some pertinent results of this are: close folding; large scale faulting; low angle faulting; faults close together and often buried; thick and rapid sedimentation; and important changes in sedimentation and reservoir lithology within distances shorter than the dimensions of many individual oil fields.

Some of the results of this type of geology have been recognized in the literature on well spacing, but all too frequently they have been brusquely dismissed as minor. Sunset-Midway whose total production is slightly under a billion barrels of oil is not minor. Sunset-Midway is one of the many California oil fields where such conditions prevail. Coast geological features may be minor in eastern geological provinces; but likewise limestone reservoirs are of no importance in California.

The much criticised Long Beach field is actually wider spaced per acre foot of oil sand than some of the model development examples of the east. The principal area of some 1300 acres with some 1400 wells has well in excess of 1000 feet of oil

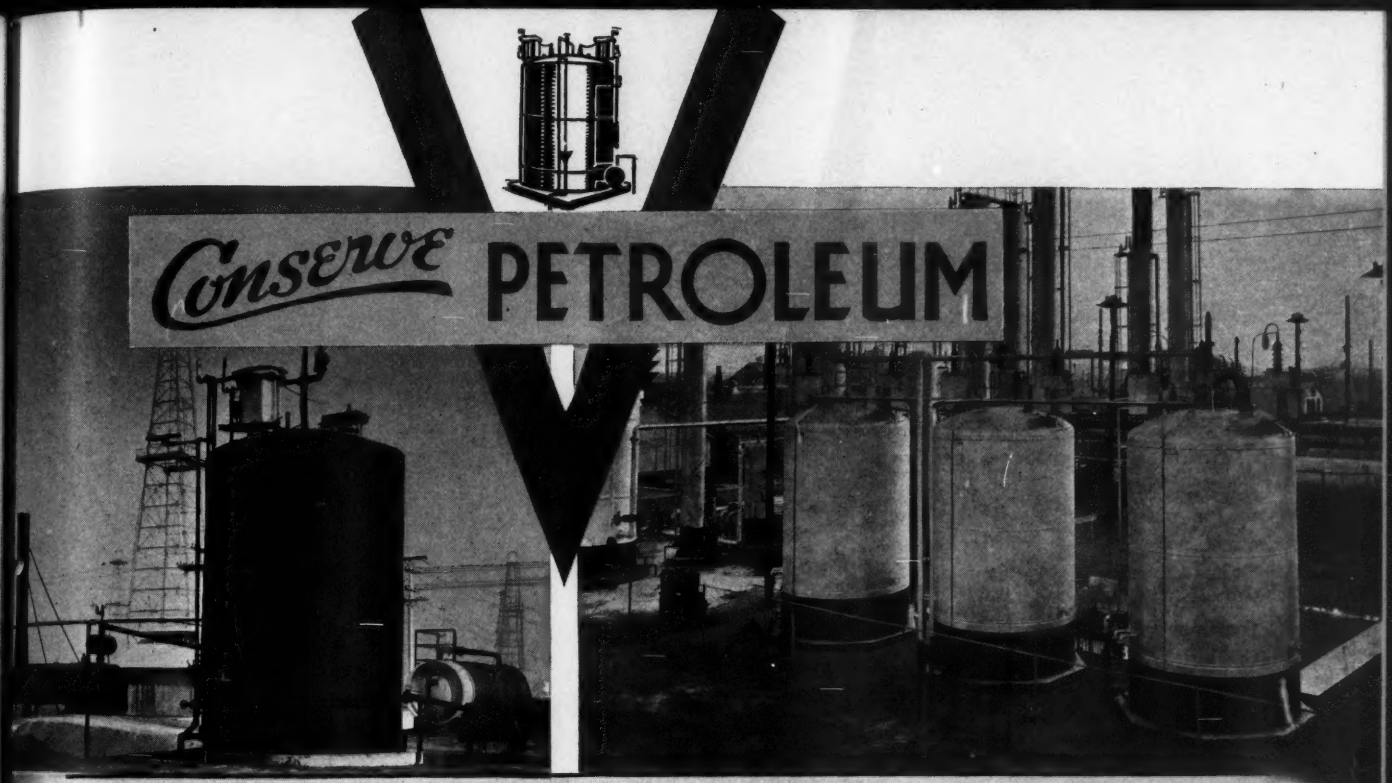
William W. Porter II

sand. This results in roughly 1 well per 1000 acre feet of sand. It is therefore comparable to development elsewhere with 10 acre spacing and 100 feet of sand, or 100 acre spacing with 10 feet of sand. Recovery has been about half a million barrels per acre.

Furthermore neither the economic import nor the sociological and military aspects can be ignored. The great per acre yield caused lease values to reach and sometimes exceed $5000 per acre. A 40 acre spacing regulation in 1923 would have had the practical and anti-social effect of handing this reserve of well over half a billion barrels of oil over to a handful of operators because only those few could have been able to acquire 40 acres of $5000 per acre and then drill a well. Such a ruling would have required at least $250,000 per drill site for participation in the Long Beach oil reserve, and would thus have removed from many citizens their right to engage in the oil business. However, under "close" spacing a number of independent operators got their start in the oil business. And a number of those companies, because of healthy subsequent growth elsewhere, developed from that start to a today's position of being capable each of supplying the entire West Coast military needs for petroleum.

A further argument fallaciously urged in favor of wide spacing can be found, stated very similarly, in publications of learned associations, in publications of oil journals, and in the official records of Congress (Cole bill testimony, for example). All of these sources cite close spacing with uncontrolled flow and generally bad production methods as being inferior to wide spacing with controlled flow and generally good production methods. These weighty conclusions are drawn from comparisons of the results obtained from different spacing grids under **unlike** production methods. Such muddled reasoning has a more appropriate place in an Amos 'n Andy comedy than in technical literature. Has nobody heard that controlled flow and the best production methods can be and frequently are applied to close spacing, and that bungling production methods are not totally unknown where the spacing has been wide?

It is not the purpose here to urge close spacing. The purpose is pointedly to avoid urging any particular spacing in general (and to hope that others will do likewise). Under a program of orderly and scientific development of oil reserves no particular plan can be applied to the different geological provinces of the United States, nor always to all of the fields in the same province, nor even to all parts of each single field in California, at least. Proper spacing is definitely related to geology as well as to physics and other matters, and the geology of fields or districts cannot be taken glibly for granted as it has been frequently. Effective conservation can be accomplished only if the laws of phys-



All The Way From the WELL Through The REFINERY

BENEFITS of PETRECO DEHYDRATING and DESALTING to:

The PRODUCING DEP'T: Petreco dehydrating, accomplished in the most efficient and economical manner in completely closed dehydrator units, assures the lowest M & B S cuts and highest shipping gravities; enabling users to meet the strictest conservation requirements and at the same time appreciably increase the revenue from the sale of their oil.

The PIPE LINE DEP'T: Complete Petreco dehydration at the wells assures lower viscosity crude and reduced pumping costs; with increased pipe line and tank capacities, and reduced corrosion due to salt water.

The REFINING DEP'T: At the refinery, Petreco's Desalting Process takes over, protecting costly refining equipment against corrosion, plugging, scaling, and the lost operating time caused by salts in the crude charging stock. Ammonia usage is reduced materially, and on-stream time increases as high as 1000% are cited by Petreco users. In many cases, specific improvements in refined products have been cited.

The producing, pipe line, and refining departments all benefit directly or indirectly by Petreco's dehydrating and desalting processes. And in addition, the crude oil and its various products are conserved and improved in conformity with the needs of our National Defense Program.

Oil companies, both in the United States and South America, are extending the use of Petreco processing with electric dehydrators at the wells and electric desalters at the refineries.

For any dehydrating or desalting problem, call on Petreco. Representatives convenient to all fields and refining centers are always at your service. Preliminary tests and surveys entail no obligation whatever.

PETROLEUM RECTIFYING COMPANY of CALIFORNIA

General Offices: Los Angeles, California

Gulf Coast Division: Houston, Texas — *Eastern Division:* Toledo, Ohio

Representatives In Principal Oil Fields and Refining Centers

PETRECO

DEHYDRATING DESALTING

ics and the data on drainage, phase behavior of fluids, and other reservoir engineering data are applied in accordance with sound geological principles.

California has been the recipient of much criticism from both private and official sources regarding its conservation methods, well spacing, and otherwise as to its conduct. It is unfortunate that critics seem to have accepted a superficial conclusion as to the reasons for the things they criticised. In spite of California's claims to many superlatives,—the highest mountain, the biggest ocean, the thickest Cretaceous rock section, the biggest telescope mirror, and so on to the finest climate,—it does not really follow that California has the biggest percentage of cussedness in the oil business. California's rejection of notions and procedures reported to have worked well elsewhere, and California's conduct of oil operations in a manner which apparently seems unorthodox to many easterners has a more fundamental explanation that can be found in the unique character of the geology of the California coast ranges and basins where the oil fields occur.

These geological conditions differ so radically from those of Texas, the Mid-Continent, and other oil areas of the United States that they dictate not merely minor adjustments of procedure, but a difference in the general philosophy of oil development. If this fact is recognized, California production, conservation, and development methods will be found to compare favorably with those of any other area, and to have many points of superiority. And recognition of this fact should also provide regulations consistent with a war in the Pacific. It is neither good operating practice nor sound conservation to superimpose spacing and development regulations from the gentle geological structures of the Mid-Continent and Texas upon the tumultous Tertiary geology of the Pacific Coast.

California's position of being isolated from eastern oil supplies throws on the Pacific Coast the problem of supplying oil for military, industrial, and civilian demands of a Pacific war. Consequently it is vital that regulatory orders be consistent with the peculiarities of California geology. The pressing need for immediate revision of regulations such as M-68 to a form consistent with the good operating practice dictated by the geology of the provinces where such regulations are applied is of vital national importance.

Charles Reichert Made Dist. Material Director

Appointment of Charles T. Reichert as district director of materials for District 5, was announced by Deputy Petroleum Coordinator Ralph K. Davies.

His assignment will be that of assisting suppliers and the oil industry of the region generally in the solution of priorities and other problems related to the procurement of essential supplies, equipment and materials.

Mr. Reichert has had a long experience in the oil industry equipment business.

Mr. Reichert's first experience with the oil industry came when he worked as a roustabout in the San Joaquin Valley fields of California. For two years he was employed in field store operations by the old Associated Supply Co., and then, in 1917, became connected with the National Supply Co. He was associated with this company for 16 years, serving in various capacities, including that of engineer in charge of research on absorption plant methods.

Mr. Reichert became general manager of sales for the Grant Oil Tool Co. of Los Angeles in 1933. The following year he engaged in general sales activity for the Petroleum Equipment Co. of Los Angeles, specializing in field store operations, and in 1935 returned to the National Supply Co. as sales engineer and manager of the production equipment division.

District 5 embraces the States of Arizona, California, Nevada, Oregon, Washington, and the Territories of Alaska and Hawaii. Mr. Reichert's headquarters will be in the Subway Terminal Building, Los Angeles, California.

Attorney (to opponent): "You're the biggest boob in town."

Judge (rapping for order): "Gentlemen, you forget that I am here."

Engineering, Technology, latest news—twice a month in California Oil World.

API Completing Plans For Coast Spring Meet

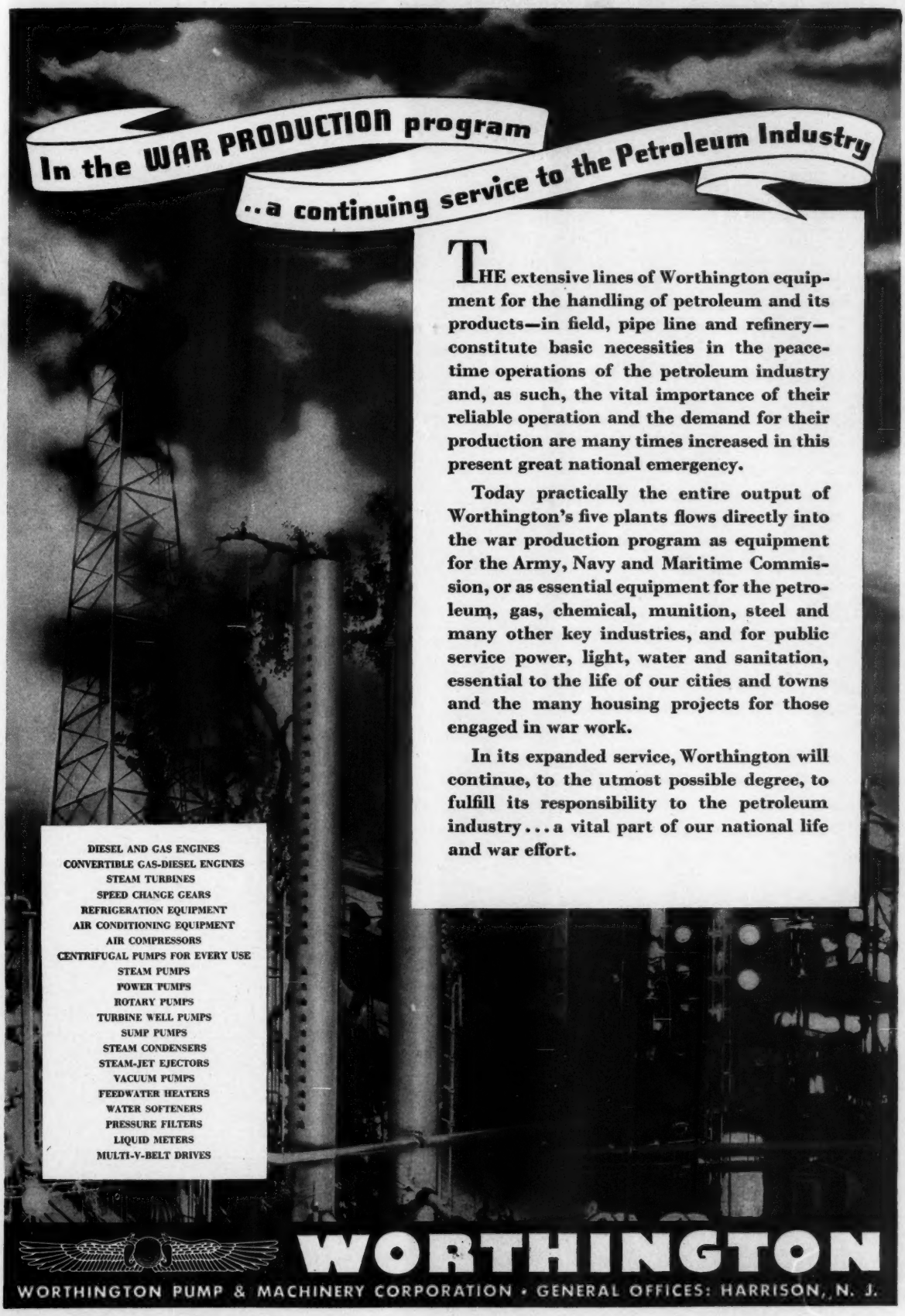
Nearing completion are the plans for a timely program of papers fea-

Bruce H. Robinson

turing the petroleum industry's part in the national war effort, and scheduled for presentation March 10, at the

W. C. Kinder

Spring Meeting of the Pacific Coast District, Division of Production of American Petroleum Institute. This announcement was made by Bruce H. Robinson, chairman of the Pacific Coast Division. Chairman of the General Arrangements Committee is W. C. Kinder.


In the WAR PRODUCTION program
..a continuing service to the Petroleum Industry
THE extensive lines of Worthington equipment for the handling of petroleum and its products—in field, pipe line and refinery—constitute basic necessities in the peacetime operations of the petroleum industry and, as such, the vital importance of their reliable operation and the demand for their production are many times increased in this present great national emergency.
Today practically the entire output of Worthington's five plants flows directly into the war production program as equipment for the Army, Navy and Maritime Commission, or as essential equipment for the petroleum, gas, chemical, munition, steel and many other key industries, and for public service power, light, water and sanitation, essential to the life of our cities and towns and the many housing projects for those engaged in war work.
In its expanded service, Worthington will continue, to the utmost possible degree, to fulfill its responsibility to the petroleum industry... a vital part of our national life and war effort.
DIESEL AND GAS ENGINES
CONVERTIBLE GAS-DIESEL ENGINES
STEAM TURBINES
SPEED CHANGE GEARS
REFRIGERATION EQUIPMENT
AIR CONDITIONING EQUIPMENT
AIR COMPRESSORS
CENTRIFUGAL PUMPS FOR EVERY USE
STEAM PUMPS
POWER PUMPS
ROTARY PUMPS
TURBINE WELL PUMPS
SUMP PUMPS
STEAM CONDENSERS
STEAM-JET EJECTORS
VACUUM PUMPS
FEEDWATER HEATERS
WATER SOFTENERS
PRESSURE FILTERS
LIQUID METERS
MULTI-V-BELT DRIVES
WORTHINGTON
WORTHINGTON PUMP & MACHINERY CORPORATION • GENERAL OFFICES: HARRISON, N. J.

Generation of Steam as a Factor in

Modern-Refinery Heat Economy

Wheaton W. Kraft, Valentine Mekler, and Ralph H. Riemenschneider
The Lummus Co.

This paper discusses the recovery of heat in various refinery operations by utilizing it for steam generation. With the advance in modern thermal processes which employ increased temperature and pressure levels and also in modern catalytic processes, the removal of large amounts of excess heat existing in the system by using this heat for generating steam offers a simple flexible, and economical solution to the refiner, especially when the cooling-water and steam conditions are not satisfactory.

Aside from employing heat exchangers on a number of hot streams available within the process system, the installation of surface in the convection section of oil heaters under certain conditions has been employed successfully for steam generation, particularly on heaters requiring expensive alloy material for tubes and fittings in oil service. Steam generation and its effect upon selection of pumps and reduction in utilities consumption are outlined.

The selection of the type of steam-generating equipment to be employed depends on the number, temperature, and pressure level of various hot streams available from the particular operation, and also upon the cost of tubes and headers required in the oil heaters.

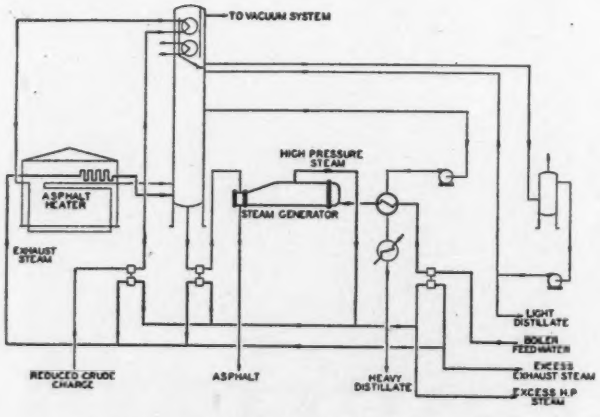
Typical installations of steam generation as incorporated in asphalt distillation, thermal polymerization, and combination cracking units are discussed and illustrated by flow diagrams and tables.

The recovery of heat is one of the important factors affecting the profitability of refinery operation. Operations such as distillation, thermal and catalytic cracking, polymerization, solvent refining, dewaxing, and many more processes are dependent upon an outside heat source. With the trend at the present time in the direction of improved-quality motor fuels and lubricating oils, many newly developed processes require still more heat, which means that heat recovery will have not only continuing but increasing interest for the refiner.

The transfer of heat from a hot stream within or leaving a process unit to a cold stream entering the unit has been the basis for most of the heat-exchange equipment at present employed. This has led to the widespread use of liquid-liquid and vapor-liquid exchangers to effect fuel savings by reducing the external heating requirements. The extent to which hot streams may be used economically for heating cold streams is determined by comparing the cost of installing and maintaining equipment for heat recovery with the saving in fuel cost which results. There is always a point of economic balance above which the additional cost of heat exchange will exceed the saving in fuel. The same principle can be applied to heat recovery from hot gases leaving direct-fired heating units, because the added cost of heating surface for increasing the efficiency of fired heaters eventually will reach a point where it overbalances the resultant saving in fuel.

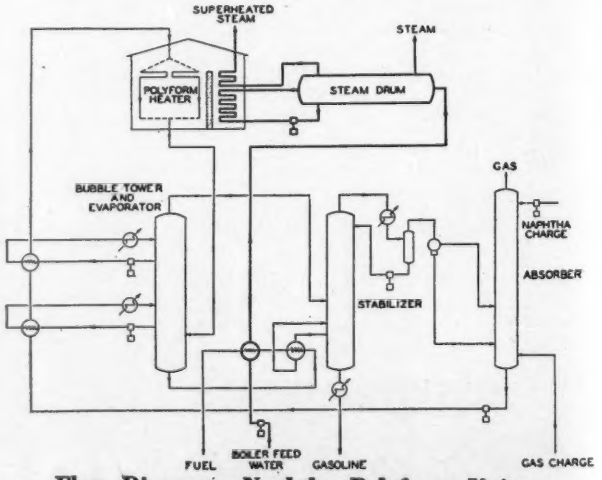
In heat exchange between hot and cold streams, the cold stream can be raised economically only to a certain temperature level, so that in most cases additional heat to the cold stream must be supplied by direct-fired heating. Hot streams, after having given up some heat through heat exchange with cold streams, still are at a fairly high temperature level, and, hence, must be cooled to the desired temperature by an external cooling medium, i.e., water. There are also cases in which the maximum temperature to which the cold stream can be heated is limited by the necessity of avoiding vaporization or for other reasons. The next result is that large quantities of heat must be removed by cooling water, with attendant cost of water-pumping

This paper, presented at a recent A.P.I. Meeting, is of special interest at this time when every effort is being made to lower costs of production.



Flow Diagram—Asphalt Distillation Unit.

FIG. 1



Flow Diagram—Naphtha Polyform Unit.

FIG. 2

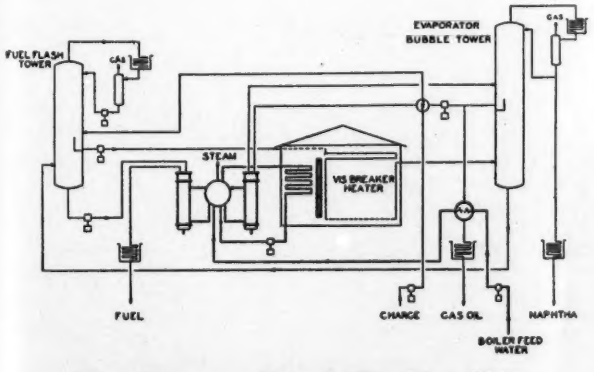
equipment, cooling-tower equipment, etc. Because the cooling-water situation at a great many refineries is far from ideal, the cumulative effect is higher operating cost. Coincidental with added cooling-water requirements is the need for more steam for pump drives and sundry process uses. One solution of the situation outlined is to recover much of the heat which otherwise would be dissipated to cooling water or to stack gases by employing it for the generation of steam.

This practice is not new, but in recent years many developments and modifications have been made which have increased its value and usefulness. The more general acceptance of steam generation for heat recovery has been accelerated by the increased temperature and pressure level and high internal cycle employed in thermal processes, and also by the many new catalytic processes which require the removal of a great amount of excess heat created by process requirements. The trend of increased temperature levels and excess heat available in modern refining practice leads to a greater demand for both cooling water and steam, which makes heat recovery by steam generation most attractive.

For refinery units of large capacity, a factor which must be considered in intelligent design is the need for a certain amount of flexibility as regards charging material and operation for market requirements. There are a few locations wherein a constant supply of uniform-quality crude oil can be counted on, but a great many refiners must process different crudes in various proportions, depending on the source of crude supply and changes in market conditions. For a combination selective thermal cracking unit, this may mean a considerable increase in light-end cracking when a paraffinic-type crude with high gasoline content of low octane number is available or, on the other hand, it may shift the cracking load to viscosity breaking and heavy-oil cracking if a heavy-naphthenic or asphaltic-type crude must be run. Such a change in cracking load has a corresponding influence on the heat-recovery system of such a unit and, rather than provide for flexibility by the installation of considerable over-surface in heat equipment on the several hot streams which will vary the most, it has been found advantageous to install a steam-generating system having multiple elements that allow the desired flexibility. These elements can be made uniform in size and so manifolded that they may be shifted from one hot stream to another as shifts in heat load occur. The overall heat recovery from such a system normally is reasonably constant in spite of considerable variation in individual hot streams, so that the over-surface requirements can be kept to a minimum in comparison with heat exchange between hot and cold oil.

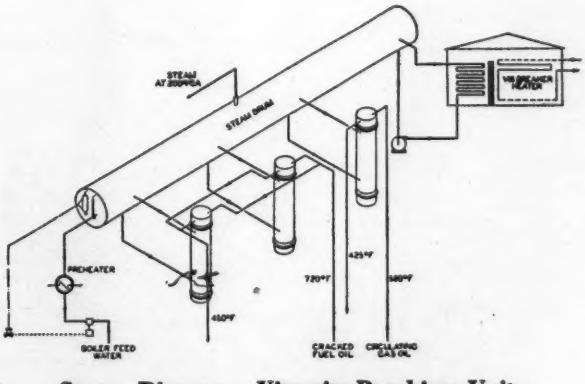
In addition to shell-and-tube type units, the installation of steam-generating surface in the convection section of direct-fired heating units has been employed successfully and economically. Tubes and fittings for oil service often are of expensive alloy material for withstanding the temperature and pressure conditions encountered; and, as higher heat absorption rates are obtainable from radiant or semi-radiant tubes than from convection tubes, any alternate method of recovering useful heat from hot gases by convection tubes becomes attractive. In some cases the savings effected by using radiant instead of convection tubes for oil service have paid for the cost of installing steam-generating surface in the convection section. The effect of any variation in oil-heating load upon the heat available in hot gases is absorbed readily by a steam-generating coil in the convection section.

Selection of the type of steam-generating equipment for heat recovery depends on the steam characteristics desired and on the particular operation under consideration. This is influenced by the number and temperature and the pressure level of various hot and cold streams, their respective heat transfer rates and fouling factors. Most steam generators installed are of the circulating type rather than the once-through type, so that heat is transferred from



Flow Diagram—Viscosity-Breaking Unit.

FIG. 3



Steam Diagram—Viscosity-Breaking Unit.

FIG. 4

the tube wall through a boiling-water film accompanied by high velocities on the water side. This mechanism makes possible the economical recovery of heat from such hot streams as tar, asphalt, and other residual oils wherein fouling of heat-exchange surface by the hot medium is rapid. Inasmuch as fouling is confined to one side only, the foul medium can be put through the tubes and cleaning made easier. In case sufficient surface is indicated to warrant installing several units, cleaning can be carried out easily during operation by by-passing the fouled unit, cleaning it in place, and subsequently putting it back in service.

To illustrate the potentialities of steam generation, we shall consider typical installations incorporated in such refinery operations as asphalt distillation, thermal polymerization or polyforming, small-scale cracking, and large-scale combination cracking.

Asphalt Distillation Unit

Steam-generation equipment added to an asphalt distillation unit can be taken as a typical example of the simplest type of system. Inasmuch as the asphalt product is normally a large percentage of the reduced-crude charging stock, and as this stream is at a high temperature level, a large amount of heat is available for generation in one stream. The poor overall heat-transfer coefficient between asphalt product and reduced-crude feed, plus fouling conditions which prevent maintenance of clean transfer rates, also makes generation of steam attractive. A process factor favoring steam generation in this type of distillation unit is the positive control of the cooled temperature of the asphalt stream. With a water-cooled coil in such service, there is always the danger of too much cooling, with consequent plugging of the coil by solidified asphalt. With boiling water as cooling medium, the cooled-asphalt temperature is controlled automatically within a few degrees. A steam-generating system fits in well with an asphalt plant, because the steam requirements for this type of plant are quite large—including, besides steam for pumps and process steam, steam for tank heating and steam tracing of asphalt lines.

Fig. 1 is a simplfied flow diagram of an asphalt distillation unit incorporating generation of steam from the hot-asphalt stream.

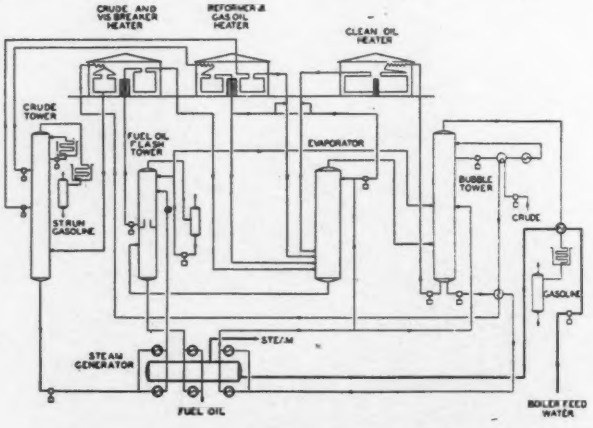
The most desirable type of generator unit for this service is a horizontal shell-and-tube unit of the kettle type with the hot asphalt flowing through the tubes and steam being generated in the shell. The generator pressure is determined by the existing steam pressure of the plant or by the pressure requirements of the unit. The feed water is heated to approximately the generator temperature from a smaller stream before it goes to the generating unit, so that the latter supplies only the latent heat of vaporization. A liquid-level controller installed on the kettle shell for controlling the input of feed water and a pressure-control valve for controlling the pressure of steam generated provide all the necessary instrumentation for the system described.

Thermal Polymerization, Polyform or Gas Reversion Units

Thermal polymerization, polyform or gas reversion units afford a good example of the type of plant characterized by high temperatures and high pressures in the fired heater coils, but with less waste heat in circulating streams at temperature levels attractive for steam generation than is the case in conventional thermal cracking units.

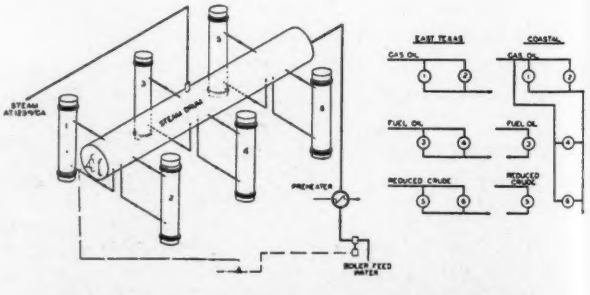
Fig. 2 shows a simplified flow diagram of such a process unit. Cold charge is preheated readily by heat exchange against circulating hot streams of the combined evaporator and bubble tower, so that convection-section heating is not attractive.

Because surface in the radiant section of an oil heater will absorb approximately three times the amount of heat per square foot as surface in the convection section, the saving in expensive tubes and fittings by putting all surface for oil heating in the radiant section usually will pay for carbon-steel tubes and fittings installed in the convection section for steam generation. A portion of the convection section sometimes is util-



Flow Diagram—Combination Cracking Unit.

FIG. 5



Steam Diagram—Combination Cracking Unit.

FIG. 6

ized for steam superheating as well as for steam generation.

The steam-generating system for this type of unit consists of a separating drum, heater tubes in the convection section, a water-circulating pump, and the necessary instruments. Water is circulated from the bottom of the drum through the heater tubes at a rate considerably higher than the rate of generation in order that at no time will there be complete vaporization in the tubes. The mixture of steam and water is returned to the drum, where the steam and water are separated by means of baffles and a dry pipe. The feed water is preheated practically to the separating-drum temperature by exchange with an available hot-oil stream. The instrumentation required consists only of means for controlling water circulation, feed-water supply, and steam pressure.

With this arrangement, considerable steam is generated at low cost, because the total investment cost of the heater, including steam-generating tubes, is no higher than if oil alone were heated. The amount of heat recovered by steam generation and superheating with this arrangement is about 25 per cent of the heat absorbed by oil, and is enough to operate the main charge pumps of the plant. Steam at pressures up to 450 psi, gage, has been generated in a system of the type shown.

Small Cracking Plant

A small cracking plant can be taken as an example of an installation with more than one source of waste heat available in hot-oil streams. Also, depending upon the particular case, it may or may not be advisable to include generation from tubes in a convection section of a heater. Inasmuch as a small cracking plant generally is designed for only one charging stock and has little flexibility, both the plant itself and the steam-generating system must be simple.

There are several possible oil streams available at high enough temperatures and of such size that steam generation is attractive. If the feed to the unit is crude oil, a fuel-oil stream of from 15 to 40 per cent of crude is available at a temperature of from 650 to 700 deg. F. The circulating gas-oil stream used for quench and reflux varies greatly with the type of process unit, but is often the largest hot stream available. This stream is at a temperature of about 700 deg. F; and, after having been used for crude preheat, is still available at a temperature of 550 to 600 deg. F for steam generation.

Fig. 3 shows a simplified flow diagram of a small-capacity viscosity-breaking unit. As the charging stock in this case is hot reduced crude, there is no liquid preheating problem, and the total heat of both circulating reflux and fuel-oil streams can be used for steam generation.

Fig. 4 shows the general arrangement of the steam-generating system itself. This particular installation includes steam generation in the convection section of the heater as

CAUSTIC SODA, NaOH
In three forms. Liquid: Colorless, semi-opaque, viscous solution. Solid: Dense, white, opaque deliquescent solid. Flake: Thin, white, opaque deliquescent flakes, practically free from dust.
CAUSTIC POTASH, KOH
In three forms. Liquid: Colorless to dark, somewhat opaque, viscous solution. Solid: Dense, dark, opaque deliquescent solid. Flake: Dense, dark, opaque deliquescent flakes, practically free from dust.
DOW
Bear Brand
LIQUID CHLORINE, Cl2
Liquefies at −34.6°C. at atmospheric pressure. Not over 1.4 lbs. moisture per ton. Total residue not over 15 grams 100 per lbs.
SULPHUR DIOXIDE, SO2
Colorless gas at normal temperatures and pressure, liquefies at −10°C. at atmospheric pressure.
CHEMICALS INDISPENSABLE TO THE REFINING INDUSTRY
ANHYDROUS AMMONIA, NH3
Colorless gas with extremely pungent odor at normal temperatures and pressure. Liquefies at −33.4°C. at atmospheric pressure. Specific gravity at 0°C. and one atmosphere 0.596; boiling point −33.4°C.
AQUA AMMONIA, NH4OH
Colorless, clear solution with pungent ammonia odor. Specific gravity at 15°C. . . . 0.89; Baumé . . . 26° −26.5°. Freezing point, below −40°F.
GREAT WESTERN DIVISION THE DOW CHEMICAL COMPANY
BEAR BRAND PRODUCTS
DOW
TRADE MARKS REG. U. S. PAT. OFF.

These Bear Brand chemicals, considered by the refining industry as indispensable, are being manufactured and supplied by Great Western. Each one proudly displays the Bear Brand trade-mark, positive assurance of consistent uniformity and purity. West Coast Refineries find these products especially advantageous . . . Strategically located shipping points are maintained on the coast—making large inventories unnecessary.

GREAT WESTERN DIVISION • THE DOW CHEMICAL COMPANY
San Francisco, California, U.S.A.
Plants: Pittsburg and Seal Beach, California
New York • Seattle • Los Angeles

well as from the hot-oil streams. The equipment includes a horizontal separating drum, a water-circulating pump, tubes in the convection section as described previously, and vertical shell-and-tube units attached to the separating drum. The hot-oil streams are circulated through the tubes, with boiling water circulating through the shell side of the bundles shown. Feed water, which has been pre-heated by a small hot stream, is fed into the drum to maintain liquid level. Such a system normally produces steam at pressures of 150 to 200 psi. If desired, steam may be generated at one pressure from the hot-oil streams and at a higher pressure from heater tubes —which arrangement, of course, requires two separating drums and two sets of instrument control.

TABLE 1
Steam-Generation Data for Large Combination Cracking Unit
(Note: Steam generated at 125 psi, gage)

	East Texas Crude	Coastal Crude
Quantity, lb. per hour	230,000	351,100
Heat removed, Btu per hour	10,700,000	31,220,000
Cooling range, deg. F	485-425	560-425
Steam produced, lb. per hour	11,800	34,400
Number of bundles	2	4
Fuel oil:		
Quantity, lb. per hour	100,700	65,600
Heat removed, Btu per hour	17,300,000	10,000,000
Cooling range, deg. F	710-415	700-400
Steam produced, lb. per hour	19,100	11,000
Number of bundles	2	1
Reduced crude:		
Quantity, lb. per hour	136,600	67,000
Heat removed, Btu per hour	16,450,000	8,370,000
Cooling range, deg. F	605-420	590-405
Steam produced, lb. per hour	18,100	9,200
Number of bundles	2	1
Total steam produced, lb. per hour	49,000	54,600

Large Combination Cracking Unit

A large-capacity combination cracking unit usually is designed for flexibility to meet variations in charging stocks and market conditions. Several sources of waste heat are available in liquid streams at temperature levels suitable for generation of steam. The fired heating units are large; and, as some of the heater charge streams are at high temperatures, steam can be generated also by employing the convection sections of these heaters. Reduced crude is available to the extent of approximately 30 to 60 per cent of the crude charge at a temperature of 550 to 600 deg. F, fuel oil to the extent of 15 to 40 per cent at 650 to 700 deg. F, and circulating gas oil at approximately 500 to 600 deg. F. These are approximate levels after allowing for economical crude preheating.

The elements of such a modern selective cracking unit are shown diagrammatically in Fig. 5. As will be seen, there are six coils for crude preheating, reforming, viscosity breaking, and virgin and recycle gas-oil cracking. The process flexibility provided by such an arrangement makes it essential to provide similar flexibility in the steam-generating system. This has been accomplished by an arrangement such as that shown in Fig. 6, which is a unique development of The Lummus Company. The combination of steam separating drum and attached vertical shell-and-tube bundles is similar to previously described systems. However, by providing multiple units and a system of manifolded hot-oil piping, as shown in Fig. 6, it becomes possible to compensate for great variations in hot-oil stream quantities and temperatures without having to install excessive shell-and-tube surface. The advantage of such a multiple-unit system clearly is indicated by the operating data of Table 1. We find that, in spite of the variations shown, the total amount of steam generated is relatively constant and the surface installed is operating at good efficiency. Although the actual installation from which these data were obtained did not include steam-generating tubes in the heater, approximately 50,000 lb. per hour of additional steam could have been produced.

The division of steam-generating equipment into a high- and a moderate-pressure system may be worthwhile for this size installation, depending upon the circumstances. Also, in cases wherein very rapid fouling occurs or wherein variations in hot-stream flow and temperature are even greater than shown, the use of properly manifolded spare shell-and-tube bundles should be considered.

Conclusions

We have indicated in this paper some of the many applications for steam generation in refinery operations, all of which were the result of studies made to improve heat economy. What this means in terms of utilities requirements is shown by Table 2. For example, we find that the asphalt distillation unit is more than self-supporting as regards steam for pumps, vacuum jets, and fuel-oil atomization—with ample exhaust steam available for process use. The naphtha polyform unit, with high-pressure heater charge pumps can depend upon a large and uniform steam supply, with most of this steam at 100 deg. F superheat. The electric load indicated results from the choice of motor-driven centrifugal pumps for most low-head services, making this plant more than self-sufficient as regards steam-driven pumps. As can be seen from Table 2, the quantity of steam generated amounted to 60,000 lb. per hour for this unit. Conditions for the small cracking unit are similar to those for the asphalt distillation unit. The economics of electric power and steam cost dictated the choice of

TABLE 2
Steam-Generation Data for Typical Refinery Units

	Asphalt Distillation Fig. 1	Naphtha Polyform Fig. 2	Small Cracking Fig. 3	Large Combination Cracking Fig. 5
Type of Unit				
Flow diagram				
Capacity, bbl. per day	4,000	13,000	5,000	22,000
Steam pressure, psi, gage	120	150	200	125
Steam from hot streams, lb. per hour	4,500	12,000	10,600	49,000
Steam from convection tubes, lb. per hour	.....	48,000*	7,400	.....
Total steam generated, lb. per hour	4,500	60,000	18,000	49,000
Total steam requirements, lb per hour	3,500	48,000	8,000	58,000
Total electricity requirements, kw	30	400	85	1,100
Total heater duty, millions of Btu per hour	13.3	200.0	45.5	245.0
Heater steam generation, per cent of total heater duty	.....	30.0	20.0	.....
Hot-oil steam generation, per cent of total heater duty	40.0	7.0	28.0	24.0
Reduction in cooling-water requirements (30-deg.-F rise), gal per min.	360	950	850	3,900

* 100 deg. F superheat at 125 psi

TABLE 3
Economics of Steam Generation

	Asphalt Distillation Fig. 1	Naphtha Polyform Fig. 2	Small Cracking Fig. 3	Large Combination Cracking Fig. 5
Type of unit				
Flow diagram				
Additional investment, dollars	3,980	32,600	14,250	42,200
Savings in water circulation, dollars per month	150	420	360	1,680
Value of steam generated, dollars per month	840	11,200	3,400	9,200
Cost of additional fuel, dollars per month	.....	1,500	600	.....
Net return, dollars per month	990	10,120	3,160	10,880
Payoff, months	4.0	3.2	4.5	3.9

drivers for pumps in the large combination unit. The amount of steam generated proved sufficient for normal operation, although a demand on the refinery boiler plant of 9,000 lb. of steam per hour is indicated as a maximum condition. The reduction in cooling-water requirements for all examples also merits attention. If we note the relationship of heat recovered by steam generation from hot streams to the external heat added to oil, we can obtain a measure of reduced cooling-water requirements, because external heating requirements and external cooling requirements are approximately the same. Steam generated from hot-oil streams, expressed as per cent of the total heater duty, may be as high as 40 per cent, as indicated by Table 2.

Table 3 shows the economics of steam generation applied to the refinery units taken as typical examples.

Under the heading "additional investment" is included the cost of all extra equipment required, such as surface in heaters, shell-and-tube equipment, drums, instruments, pumps, piping, etc.

The value of steam is taken as 26 cents per 1,000 lb.; of fuel, as $1.00 per barrel; and of water, as 1 cent per 1,000 gal. The indicated payoff period is seen to be very short, ranging from 3 to 4½ months.

We have shown the value of steam generation as a means of recovering waste heat from liquid streams and hot furnace gases for a number of typical refinery operations. We have discussed the flexibility and process control obtainable from such installations, and the factors which determine the choice of the specific type of equipment employed. It should be noted that operations in many existing plants can be made more economical by heat recovery through generation of steam.

George Stevenson Promoted By American Meter Co.

George Stevenson, sales engineer, has been appointed assistant manager of American Meter Co's Pacific Coast Factory and Sales Service with Headquarters in Los Angeles.

The promotion comes in recognition of Mr. Stevenson's fourteen years of able service with the company. After attending California Teachers' College and subsequently graduating from the Polytechnic School, in San Francisco, he joined the office force of American Meter Co's branch in that city. By 1930 he had become General Office Clerk, and six years later was appointed sales engineer and transferred to the Los Angeles branch. The transfer was signalized by his marriage to Georgette Paston, in San Francisco.

Mr. Stevenson's father was a veteran hotel manager in San Francisco as well as the popular manager of the Claremont Country Club, of Oakland. George himself followed his aptitude for gas engineering and is a member of the American Gas Association, the Pacific Coast Gas Association and the California Natural Gasoline Association.

In connection with his Association activities, George Stevenson was Chairman of the Program Committee, Southern California Meter Association, in 1937, and has served as Chairman of the Entertainment Committee of that association. He also has been an energetic worker in the California Natural Gasoline Association.

Engineering, Technology, latest news—twice a month in California Oil World.

Field Developments

Los Angeles Basin

Long Beach Anticipates Reconditioning Program

The virtual ban now existing on the drilling of new wells is expected to result in a wide program of reconditioning in the Long Beach field. Many wells can be perforated in sands now cased off and many more can be improved by simple redrilling operations which require little or no new casing.

Newhall-Castaic News Reported

Most promising wildcat in the Newhall-Castaic area is C. G. Willis & Associates No. 1 on the Ferguson property in sec. 36, 4n-17w. Bottomed at 7519 ft., the well is reported to have found the Third Zone barren at 7220 ft. and to have plugged back to the First and Second Zones. At 6400 ft. the well entered Miocene formations and at 6700 ft. an oil zone comparable with the first oil sands in the Newhall-Potrero field were found. The hole was cored ahead through the upper sand phases and casing was cemented at 6857 ft. after which hole was opened to 7170 ft. where a formation test of the base of the First Zone and the top of the Second Zone resulted in a flow estimated at 500 bbls. a day of 33 gravity clean oil.

In Towsley Canyon, three miles southeast of the Willis try, the Barnsdall - Ambassador - Bandini wildcat, Limbocker No. 1 was bottomed at 7056 ft. and is being tested in meagre showings encountered near the 2000 ft. level. Drilled near the apex of a sharp fold, this well encountered steeply dipping formations all the way down.

Roy W. Young, Inc. Walker No. 1, sec. 11, 4n-16w in Boquet Canyon, is drilling below 7750 ft. in hard shale with occasional streaks of sand which show light cuts.

North of Castaic Junction and west of Highway No. 99, Mangold and Morse Oil Co. is washing over a drill pipe fish in McDermott No. 1. The hole is bottomed at 2632 ft. in the top of the Del Montion Conglomerate.

Airline Oil Co., which spudded Perkins No. 1 two months ago in sec. 11, 3n-16w, has removed the portable rig and is now going ahead with heavy rotary equipment.

2nd Turnbull Well Nearing Completion

Turnbull Community No. 2, Continental Oil Co.'s second well in

LOS ANGELES BASIN WILDCATS

Area	Well	No.	Section	Depth	Status
Castaic	Mangold & Morse Oil Co., McDermott	1	26, 5-17	2632	Fishing D.P.
	Young, Roy, W., Inc., Walker	1	11, 4-16	7720	Drilling
	The Texas Co., Fernando	1	11, 4-17	8034	Abandoned
Newhall	Airline Oil Co., Perkins	1	11, 3-16	200	Prep. to deepen
	Barnsdall Oil Co., Limbocher	1	17, 3-16	7056	Testing
	Willis & Assoc., Ferguson	1	36, 4-17	7396	Drilling
Palmdale	Wesco Const. Co., Well	1	20, 5-9	2785	Drilling
Palos Verdes	Surety Holding Co.	1	22, 5-14	1221	Drilling
Puente Hills	Axis Pet. Co., Tandberg	1	13, 2-11	4007	Drilling
	Axis Pet. Co., W. R. Rowland Ranch	1	21, 2-10		Prep. to spud
	Continental Oil Co., Turnbull Comm.	2	13, 2-11	3841	Stdg. plugged
Rio Hondo	Potrero Oil Co., Well	1	32, 1-11	5370	Fishing D.P.
San Fernando	Fernando Oils., Ltd., Chatsworth	1	18, 2-16		Rig
	Shell Oil Co., Mission	2–1	25, 3-16	5667	Drilling
	Tide Water Assoc., Mission	1	26, 3-16	8955	Drilling
	Tide Water Assoc., Sesnon	1	28, 3-16	2121	Drilling
West Whittier-Rideout Hts.	Bell View Oil Synd.	"P" 1	17, 2-11	1655	Stdg. plugged
Whittier-La Habra	Los Nietos Valley Oil Co., Woodard	1	29, 2-11	50	Idle
	Union Oil Co., Sansinena	13	30, 2-10	4143	Plugged 2627 Completed
	Orange County				
Anaheim	The Texas Co., Spencer	1	1, 4-11	9660	Testing
Bolsa Chica	La Bolsa Ro. and Synd., Well	1	22, 5-11	3361	Drilling
Costa Mesa	Thompson, Milton N., Banning	1	9, 6-10	5649	Fishing D.P.
Kraemer	Atlas Oil Co., Kraemer	1	36, 3-9	2675	Idle

the Turnbull Canyon field discovered last fall, is nearing completion after bottoming the redrilled hole in poor oil sand at 3841 ft. and plugging to 3707 ft. Turnbull No. 2 opened up 400 ft. of formation below the bottom of the discovery well and will test sands not open in its predecessor.

Three quarters of a mile northwest of the Continental operation, Axis Petroleum Co. is coring below 4100 ft. in Tandberg No. 1 at the corner of Turnbull Canyon Road and La Mesita Drive. Formation tests above the 3500 ft. level indicated that at least small production can be expected of this well.

Two miles east of Turnbull Canyon Road, Axis Petroleum Co. is spudding a second wildcat well which is located near the west quarter corner of sec. 21, 2s-10w. This well will test a hitherto untried structure.

Texas Co. Testing Anaheim Area Well

Releasing no more information than if the operation were a military secret, The Texas Co. is making a series of tests in Spencer No. 1 on the Buena Park-Anaheim Highway. Casing was cemented on bottom at 9660 ft. and several intervals have been perforated below 8700 ft. Little encouragement was gained from tests below 9000 ft. but a trial at 8750 ft. is said to have resulted in a small flow of heavy oil.

Universal to Deepen Aliso Canyon Project

Finding only an estimated 300,000 cu. ft. flow of gas in the interval 7425-7665 ft., Universal Consolidated Oil Co. is pulling the liner from Ward No. 1 at Aliso Canyon to deepen. Located just north of production on Tide Water Associated Oil Co.'s Porter lease, the well had encountered the deep horizon only 65 ft. lower than the deep discovery well, Porter No. 12. The low productive rate in Ward No. 1 appears due to the impermeability of the sands, and it is hoped that

FAST EFFECTIVE DRILLING

IS A MUST THESE DAYS

★ ★ ★

SPERRY-SUN CAN HELP!

Wartime production carries a double load. It must deliver the goods to meet vastly increased requirements — without waste of time or equipment.

Inefficient drilling is as unpatriotic today as it is unprofitable in peacetime.

Sperry-Sun Instruments and Services are at your call, to help you do the job our country asks.

SURWEL Clinograph
Syfo Clinograph
E-C Inclinometer
H-K Inclinometer
Magnetic Directional Tool Orientation
Polar Core Orientation
K-K Whipstock

HEADQUARTERS FOR WELL SURVEYS

SPERRY-SUN WELL SURVEYING CO.
1608 Walnut Street, Philadelphia, Pa.

Branch Offices: Houston, Lubbock, Odessa, Corpus Christi and Fort Worth, Texas; Oklahoma City, Okla.; Long Beach and Bakersfield, Calif.; Lafayette, La.

in deepening 300 to 400 ft. looser sands will be found.

East of the field, Shell Oil Co. is below 5700 ft. in Mission No. 2-1 while Tide Water Associated Oil Co. is drilling Mission No. 1 at 8975 ft. Tide Water Associated's Sesnon No. 1, being drilled west of Aliso Canyon in conjunction with Standard Oil Co., is drilling in hard sand and shale below 2150 ft.

Bell View to Test Rideout Heights Well

Bell View Oil Syndicate is setting casing to make a production test in its "P" No. 1 situated just north of the intersection of Norwalk-Puente Mills Road and Beverly Blvd. in the old Rideout Heights field west of Whittier. Tar sands were encountered in streaks below 960 ft. and the hole is plugged from 1655 ft. to 1270 ft. where a combination string is being landed. Best showings were reported from 1200 ft. to the top of the plug.

Havenstrite Completes Del Valle Outpost Well

Flowing 129 bbls. a day of 42 gravity oil and 1,180,000 cu. ft. of gas, R. E. Havenstrite, Operator, completed Liebhart No. 1 to push the productive limits of Del Valle one location to the east into sec. 16, 4n-17w. The hole is open in two intervals in the Del Valle Zone from 7011 to 7096 ft. Lincoln No. 9, drilled to 7623 ft. in brown shale, is standing with 5½ in. casing cemented at 6354 ft. preparatory to testing for production.

In the westerly portion of the field, Standard Oil Co. finished Sepulveda No. 2 flowing 133 bbls a day of 33.6 gravity oil from 15 ft. of perforations open in the Jasper Zone below 5790 ft. Jack Herley and Paul Kelley's Videgain No. 2 failed to flow and was brought in pumping 215 bbls. a day cutting 15.0%.

Redrill Jobs Increase In Wilmington Field

A sharp increase is noted in the number of redrilling operations in the Wilmington field since the famous order No. M-68 has nearly put a stop to new drilling. Among those who have already started or expect to get under way in the immediate future are Rush, Nelson & Graham, Royalty Service Corp., Sonwell Oil Co., Macmillan Petroleum Corp., Wm. A. Kirk, MacDonald & Burns, Meredith & Beem and R. T. Colter.

Probably through misinterpreting M-68, several operators have started new wells but in the future none can be drilled without the granting of exceptions by the Petroleum Coordinator's Office.

Engineering, Technology, latest news—twice a month in California Oil World.

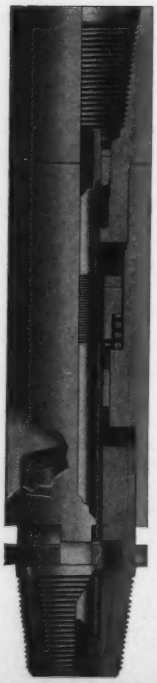
NO. 1 HOW BOWEN TOOLS CONSERVE COSTLY WELL EQUIPMENT

Back-Off Proof Connections
with the
BOWEN BOX SPEAR

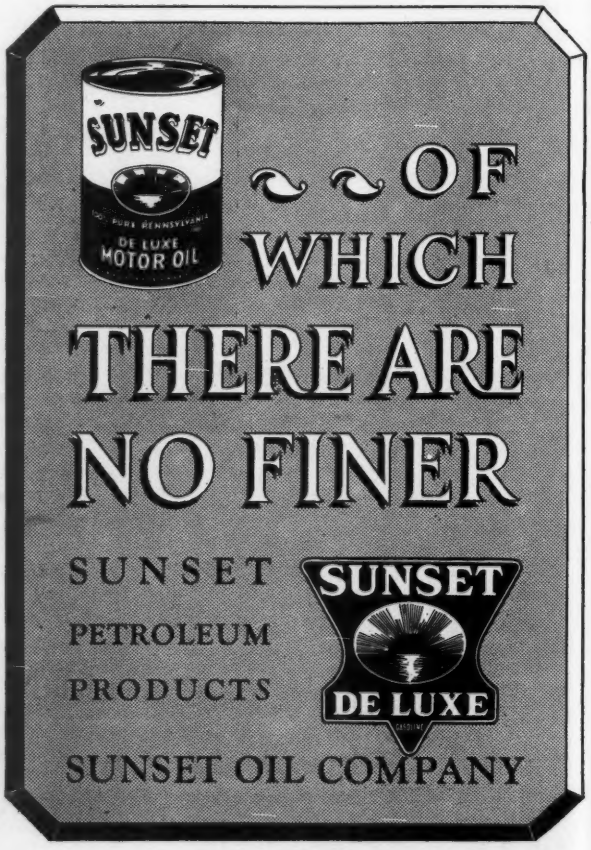
"Tight-hole" fishing jobs need not be abandoned just because you can't use an outside fishing tool. When tool joint box or coupling is up, the *Bowen Box Spear* offers several important advantages . . .

This Spear *threads* right in to the box or coupling, then *binds* so that the joint is back-off proof. With the hold it provides you can pull up, or back off a weaker joint below, easily and safely—with any strain or torque the fishing string will safely stand. To release in the hole, simply lower the run-in string and rotate to the right to disengage the Spear threads from the fish.

Calling your nearest Bowen Store and specifying size and type of drill pipe box or coupling you want to catch will bring the correct Box Spear to your rig at once. *Dependable 24-hour service in all active California fields!*



BOWEN FISHING TOOL CO.



Barnhart-Morrow Finish Wilmington-Torrance Well

Pumping 75 bbls. a day with a cut of 30%, Barnhart-Morrow, Consolidated completed Spring No. 1 as the most northerly well in the Wilmington-Torrance area. The well is located north of Lomita Blvd. and east of Figueroa St. and was bottomed at 3717 ft. Perforations are open at intervals below 3180 ft.

Southwest of the intersection of Figueroa and Pacific Coast Highway, Rosetta Oil Co. is completing Capital No. 2 at 3684 ft. after cementing 6⅝ inch casing at 3096 ft. and landing a perforated liner on bottom.

Only drilling well in the area is First National Finance Corp. Stone No. 1 which is now below 2700 ft.

Jergins Completes Inglewood Producer

Last of the current crop of drilling wells at Inglewood was completed in the deep zone by Jergins Oil Co. The company's Howard No. 3, located at the extreme north end of the field, was bottomed at 8498 ft. and brought in flowing 1100 bbls. of clean oil a day.

Standard Oil Co.'s last well, Vickers No. 2-14, came in for 1500 bbls. and when last reported, was flowing 450 bbls. a day through a small bean.

Unless exceptions to "M-68" are granted, there will be no more drilling at Inglewood.

Westbrook to Redrill Old Torrance Project

E. M. Westbrook and associates, operating under the name Hemco Oil Co., are preparing to redrill the old Frenger No. 3 well at the corner of Hawthorne and Redondo-Torrance Blvds. Drilled nearly 20 years ago by Shell Oil Co., the project adjoins Frenger No. 1 which was recently redrilled by J. B. Nelson & Associates.

West American Finishes Huntington Beach Well

West American Oil Co. is completing Ashton No. 11 at Huntington Beach after cementing casing on bottom at 4368 ft. and gun perforating two intervals below 4065 ft. In the same section of the old field, H. S. Kohlbush is drilling Pacific American No. 9 and has derrick erected for No. 10.

La Bolsa Well Reports Shows

La Bolsa Rancho Oil Syndicate, whose Crane No. 1 adjoins the Meadowlark golf course a mile northwest of Huntington Beach, is reported to have encountered tar showings near the 2000 ft. level. No tests were made and the well is now drilling below 3400 ft.

Engineering, Technology, latest news—twice a month in California Oil World.

2 speeds forward and instantaneous reverse on all reels
BULL REEL
Average line speed 370 FPM in high gear. Pulls to 28,900 pounds in low. Spools to 6,900' of ⅞" cable without divider.
SAND REEL
Average line speed 980 FPM in high gear. Pulls to 12,400 pounds in low. Spools to 6,200' of ⅞" cable without divider.
CALF REEL
Single line rope speeds up to 424 FPM in high; single line pull to 18,800 pounds in low, or 94,000 pounds on 6-part tackle. Spools 600' of ⅞" cable.
for
HIGH SPEED
drilling or servicing
its
Bucyrus-Erie's
36-L
The spudder that is making history in speeding up oil field production! Write for bulletin.
Harry C. Kaufman
2020 SACRAMENTO ST. • LOS ANGELES, CALIFORNIA

San Joaquin Valley

Gen. Pet. Enters Riverdale Play

General Petroleum Corp. is building rig for Community Eight No. 45-21 in sec. 21,17-19 of the Riverdale area in southern Fresno county. The well is an outpost located northwest of Amerada Pet. Corp's discovery well, Lawton No. 45-26, which was completed in December of 1941 flowing 560 barrels of 34 gravity oil and nearly a million and a half feet of gas through a small bean.

Amerada's second well, Jensen No. 54-26, in the discovery sec. 26, 17-19, is currently fishing drill pipe after a formation test from the shoe of 7 in. casing at 6775 ft. to bottom of 6941 ft. resulted in a 14,000,000 cu. ft. gas flow and recovered a small quantity of 37 plus gravity oil with some mud and emulsion. An earlier test of the interval 6538 to 6638 ft., open only 10 minutes, blew gas at an estimated 15,000,000 cu. ft. rate.

Richfield Drilling Northern Wildcat

Most northerly of all Fresno county activity is Richfield Oil Corp's Ponte No. 1, currently seeking another of the discoveries which recently have characterized Fresno county wildcatting. Last reported at 3764 ft. the "cat" is being drilled by Bell & Loffland in sec. 30,13-17.

Joint Operators Plan Guijarral Hills Well

Robert S. Lytle, Operator, Seaboard Oil Corp. and Honolulu Oil Corp. have joined forces to drill well No. 68-28F in search of Vaqueros and Eocene production in the Guijarral Hills area of Fresno county.

Foundation for the project, to be operated by the Lytle organization, has been poured 330 feet north and 1650 feet west of the southeast corner of section 28,20-16.

Located southeast of the Coalinga Eocene Pool on a trend toward the Kettleman North Dome Field, the area was drilled in the early thirties by both Petroleum Securities and Dana Hogan in search of Vaqueros production only, since at that time Petroleum Securities had not yet demonstrated the presence and productiveness of the Eocene age in the Coalinga Nose area nor had the Kettleman deep zone been discovered.

The Pet. Sec. Co. Ladd No. 1 was drilled in 1930 a little more than a quarter of a mile northwest of the current try and bottomed in barren Temblor at 7382 feet without having reached Vaqueros formations, believed in the light of recent knowledge to lie not far below the abandoned bottom. Dana Hogan's Ladd No. 1, located only a few hundred feet northeast of the new project, was bottomed in brown

SAN JOAQUIN VALLEY WILDCATS

Area	Well	No.	Section	Depth	Status
	Fresno County				
Guijarral Hills	Lytle, Robt. S., Opr., Well	68-28F	28, 20-16		Foundation
Helm	Amerada Pet. Co., Weyant	5-27	27, 16-17	8500	Completing
	Amerada Pet. Co., Clover	75-34	34, 16-17		Grad roads—Idle
	General Pet. Corp., Esperoad	75-33	33, 16-17	8017	Drilling
Jacalitos Hills	Wilshire Annex Oil Co.	41-26E	26, 3-15	4072	Swabbing
	Wilshire Annex Oil Co.	45-26E	26, 3-15	2575	Drilling
Kerman	Richfield Oil Corp., Ponte	1	30, 13-17	3764	Drilling
Raisin City	Seaboard-T.W.A.-Union, S.T.U.	86-13	13, 15-17		Foundation
	Shell Oil Co., Inc., S.A. & F.L.	31-19	19, 15-18	5077	Flowing by hds.
Riverdale	Amerada Pet. Corp., Jensen	54-26	26, 17-19	6941	Fishing D.P.
	General Pet. Corp., Comm. 8	45-21	21, 17-19		Bldg. rig
	Kern County				
Belridge—South	Ivy Drilling Co., Parkford	1	12, 29-21	1140	Pumping
	Sentinel Oil Co.	1	10, 28-20	3902	Idle
Buttonwillow	The Texas Co., S.P.	47-15	15, 29-24	4271	Comp. gasser
	The Texas Co., Bowerbank	4-23	23, 29-24	4945	Testing
Devils Den	Lang, Etienne, Occidental	2	30, 26-19	1485	Fishing bailer
Dyer Creek	Dyer Creek Oil Co., Well	1	2, 26-27		Rig
	Shell Oil Co., Smith Cairns	3	11, 26-27		Rigging up
	Union Oil Co., Villard	62-1	1, 26-27	42	Drilling
Kern River	Seaboard Oil Corp., Fuhrman	1	28, 28-28		Grade
McClung	Macrate, A. N., Haberfelde	1	32, 29-26	12035	Stdg. plugged—Idle
Midway	Western Minerals Co., U.S.A.	37-25	25, 11-23		Location
Mt. Poso	Alpha Oil Co., C. V. Elliott	1	1, 27-28	1320	Redrilling
	Bishop, Bradford, Well	2	22, 27-28		Grade
	R. R. Bush Oil Co., Rodgers-Jones	1	35, 26-27	2785	Drilling
	Vedder, D. G., Glide	23-1	23, 27-28		Location
Paloma	General Pet. Corp., Gallagher	61-33	33, 31-26	1814	Idle
	Ohio Oil Co., KCL A-10	41-4	4, 32-26	9932	Drilling
	Western Gulf Oil Co., L.A.A.C.	36-1	6, 32-27		Foundation
	Western Gulf Oil Co., Symons	12-7	7, 32-27	11811	Drilling
Richgrove	Bolling, R. S., Quinn	3	15, 25-27	2926	Reaming
	Shell Oil Co., Curry	1	20, 25-26	2577	Drilling
Shafter	Continental Oil Co., Neuman	1	36, 27-24	9949	Redrilling
	General Pet. Corp., S.P.	51-15	15, 28-24	14112	Drilling
Shale Hills	Tideland Oil Co., Grant Est.	1	4, 27-18	3010	Drilling
Union Avenue	Hancock Oil Co., Roberts	4	6, 30-28	5377	Pumping
	Richfield Oil Corp., Union Ave.	2	6, 30-28	5340	Re-perf. testing
	Kings County				
Dudley Ridge	Dudley Ridge O. C., Ltd., D.R.	3-16	3, 23-19	1627	Testing
Pyramid Hills	Pacific O. & G. Dev. Corp., West Slope	2	20, 24-18		Location
	Tulare County				
Pixley	Continental Oil Co., Pixley Comm.	1	9, 23-25		Foundation
Terra Bella	Stout, Geo. W., Stout	2	11, 23-27	745	Idle
Trico	Trico Oil & Gas Co., Lee	1	17, 24-23		Rig

shale at 6605 feet during 1933. Top of the brown shale was found at 5535 feet, higher than in the earlier driller, but apparently much thickened. This project was abandoned without having reached the Temblor.

The current effort should add much knowledge of the deep sections in the undeveloped interval between the two rich fields, each of which is productive in the deep sands.

Amerada Completing Second Helm Well

In the Helm area, some 14 miles north of its other discovery in the Riverdale area, Amerada Pet. Corp. is completing Weyant No. 5-27 as its second well in the new field. Located in sec. 27,16-17, northwest of the discovery Clover No. 31-34 in section 34, the well was bottomed at 8500 ft. after penetrating approximately 300 feet of barren Cretaceous. After cementing 5½-inch casing at 8180 feet the hole was cleaned out to 8170 feet for a shut off test which required a 30 sack squeeze job. Again cleaned out to 8170 feet the casing was gun perforated in the Eocene interval 8100 to 8110 feet with 20 shots. After running tubing the well was swabbed in flowing a 320 barrel rate of 27 gravity oil cutting 20.0% water. At present the operators are replugging in the casing shoe to shut off the water.

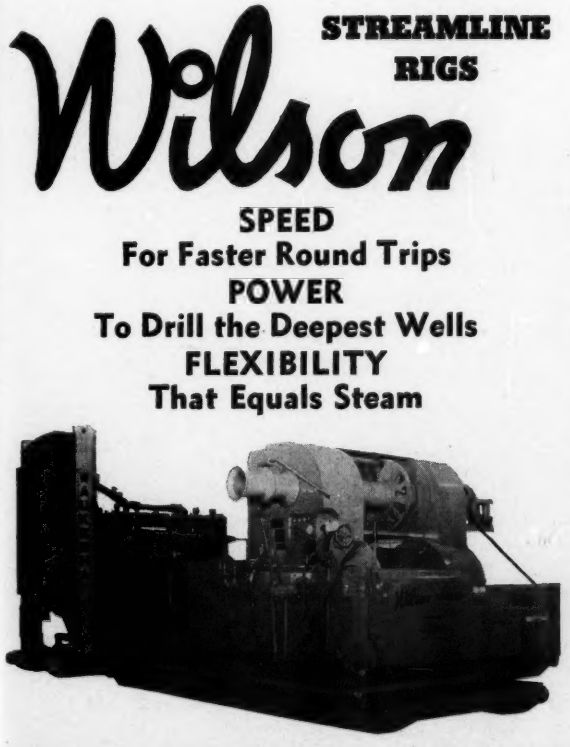
This is by no means the only zone open to test in this well since the discovery well was found productive in three intervals from lower Miocene at 7300 feet to Eocene at 8000 feet and was finished in the Miocene interval 7303 to 7313 feet with a demonstrated capacity of 662 barrels of clean 64.7 gravity condensate and 13,618,000 cu. ft. of gas.

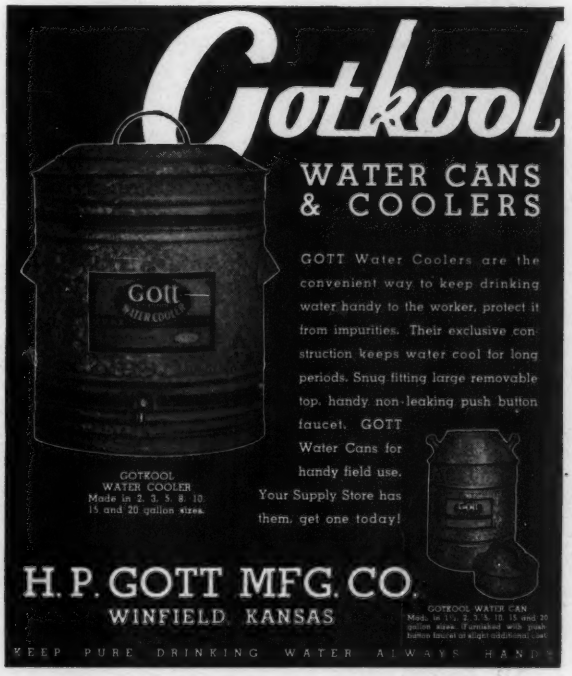
In sec. 33, 16-17, west of discovery, General Petroleum Corp. is testing Eocene sands at 8163 ft. in Esperoad No. 75-33. A formation test at the Kreyenhagen contact in the interval 7472 to 7637 ft. resulted in only a diminishing gas blow and the recovery of mud and gassy salt water.

Wilshire Developing Jacalitos Hills Field

Operating in strict conformity with the 1 well to 40 acre regulations now in effect, Wilshire Annex Oil Co. is continuing development of its newly discovered shallow Fresno county production. Because of the large extent of the acreage blocked up and the suspected but yet unproved wide area of producing sands, the field offers one of the few places where such curtailed operations may be expected to continue.

To date the company has completed two wells in sec. 26, 21-15 for approximately 100 barrels each of 40 gravity oil from the 3700 foot level. Latest to near completion is No. 41-26E, in the same section,




Gotkool
WATER CANS & COOLERS
GOTT Water Coolers are the convenient way to keep drinking water handy to the worker, protect it from impurities. Their exclusive construction keeps water cool for long periods. Snug fitting large removable top, handy non-leaking push button faucet. GOTT Water Cans for handy field use. Your Supply Store has them, get one today!
GOTKOOL WATER COOLER
Made in 2, 3, 5, 8, 10, 15 and 20 gallon sizes.
H. P. GOTT MFG. CO.
WINFIELD KANSAS
KEEP PURE DRINKING WATER ALWAYS HANDY

last reported swabbing from 4072 feet. Top of the Temblor was found here at 3980 feet with 10 feet of good oil sand cored in the interval 4009 to 4058 feet.

No. 45-26E, also in section 26, is drilling at 2600 feet in an attempt to widen the proved productive Temblor acreage.

Texas Co. Achieves New Gas Discovery

The Texas Co. re-entered its abandoned 12,138 ft. wildcat S.P. No. 47-15 in sec. 15,29-24 for shallow gas tests omitted in the earlier operations. Made needful because of increasing demand for gas fuel reserves, the operations resulted in an 11,000,000 cu. ft. gas flow from a 100 ft. section above a plug at 4271 ft.

The Company is currently attempting similar production in Bowerbank No. 4-23, drilled and abandoned by Union Oil Co. at 12,144 ft. in sec. 23,29-24 after efforts to find oil production failed.

In this case the hole was found junked and was redrilled to 4945 ft. where 5½ in casing was cemented for gun perforating trials now under way.

Dyer Creek Area Drilling Begins

On a triangular shaped play near the northeast corner of township 26s range 27e, three projects are in varying stages of progress. First to spud in search of Vedder zone production is Union Oil Co's. Villard No. 62-1 in sec. 1,26-27, now drilling in grass root stages. Rigging up for an early start is Shell Oil Co. Inc. Smith-Cairns No. 3 in section 11 of the township. Dyer Creek Oil Co., newly formed by G. A. Holtz for the purpose, has built rig for its wildcat near the west quarter corner of section 2.

The flurry of drilling is based on the hope of duplicating the solid production found in Shell Oil Co.'s Smith No. 56-X-11 in section 11 late in 1941. This try was completed for 235 bbls. of 15.3 gravity oil from 18 ft. of Vedder zone sands above 2361 ft. Subsequent unsuccessful trys in the immediate area indicate that the area is complex if not indeed extremely tricky.

Water Troubles Devils Den Try

Etienne Lang's Occidental No. 2, second well in the south Devils Den, or more specifically the Blackwells Corner area, is preparing to repair a casing break below 950 ft. after water troubled attempts to complete.

Located in sec. 30,26-19, the well was bottomed at 1485 ft. with 13⅜ in. casing cemented at 1230 ft. and 8⅝ in. liner landed on bottom. Bailing operations are reported to have resulted in an estimated 200 bbl. oil recovery before the water broke in.

Western Minerals Plans Southeast Midway Test

Western Minerals Company, headed by Wm. F. Humphrey, president of Tide Water Associated Oil Co., has staked location for U.S.A. No. 37-25 approximately 990 ft. north and 990 ft. west of the south quarter corner of sec. 25, 11n-23w, some 4 miles southeast of the Midway-Sunset field.

While much of the area was prospected to shallow depths in the early days of Valley development, little is known of the Eocene possibilities which this test, it is believed, proposes to prospect.

Continental Prepares Tulare County Wildcat

A mile and a half south of Pixley and 300 ft. east of the Golden State Hiway in southern Tulare county, Continental Oil Co. has poured foundation for Pixley Community No. 1. Located near the west quarter corner of sec. 9,23-25, the wildcat proposes trying all formations down to the basement complex. Since no drilling has been done within a radius of several miles little is known concerning its probable depth. It is known however that Compass Oil Co.'s abandoned 4322 ft. wildcat, a little more than six miles due east, encountered the schist at 4320 ft.

Seaboard Oil Co.'s Security No. 1, drilled in sec. 16,23-26 during 1937 a mile southeast of the Compass well, was wet on tests of oil sands in the interval 4116 to 4122 ft. and was abandoned at 4127 ft.

Because production men are looking sharp for ways and means to cut costs and minimize maintenance JENSEN UNITS fit neatly into the wartime economy.

HITLER DON'T KNOW IT

. . . but every JENSEN JACK on duty in America adds to the Nazi load one of those straws that eventually breaks even a camel's back.

We are all agreed that American industrial efficiency will win this war. The petroleum industry has said what it thinks of JENSEN performance. It has made us the largest exclusive manufacturer of pumping equipment in the world.

If you have no first hand information on how JENSEN JACKS cut costs and upkeep on California wells, get in touch NOW with . . .

A. V. TURNER
445 W. 6th, Downey, Calif.
Phone: Downey 47478

JENSEN
BROTHERS MFG. CO.
Coffeyville, Kansas, U.S.A.

EXPORT OFFICE: 50 Church St., New York City

Dunlap Spuds Mt. Poso "Cat"

D. D. Dunlap Oil Co.'s Lambert Lands No. 1 in sec. 29,26-28, is seeking an extension to the Ring-Vedder Pool in the Mount Poso producing group. Located 500 ft. south and 200 ft. east of the northwest corner of the section, the well if successful would materially lengthen the pool, or more probably, uncover a new fault accumulation related to the many such saturated closures comprising the group. Last reported at 550 ft., the test is being drilled by the California Commercial Drilling Co.

Signal Petroleum Co. has staked location for an outpost to the Ring-Vedder Pool in the northwest quarter of sec. 32,26-28. This too seeks production comparable to the many small pools previously discovered in the area and is predicated upon the suspected existence of a northwesterly-southeasterly fault effecting a closure against an east-west fault known to run through the northerly portion of the lease. Other projects in the area, as elsewhere, are held up pending clarification of O.P.C. order No. M-68.

Shell Testing Canal Project

Shell Oil Co. Inc. after drilling to 13,400 ft. has conceded that Vedder zone sands capable of production do not exist below the normally producing Stevens zone in the Canal oil field and has plugged its KCL No. A-44-14 back to 9506 ft. for tests of the upper zone.

Located in the center of the field near the center of sec. 14,30-25, the deep try was bottomed in siltstone and hard sand. An electric log indicated thin fingers of poor looking oil sands below 12,650 ft. The well was then plugged to 9506 ft., well into the shoe of 9⅝ in. casing cemented at 9690 ft., for shutoff tests in the lower section of the Stevens zone, topped at approximately 8050 ft. on the way down.

With the tester set at 8664 ft. a trial of 4 holes at 8387 ft. showed a net rise of 2630 ft. of oil and mud. Squeezed, the hole was again perforated with 4 shots in the interval 8418 to 8420 ft. where on an 18 hour test the well flowed oil and water at an estimated 1200 bbl. rate with the cuts ranging from 30 to 50%. Considerable quantities of gas accompanied the flow. At last report the operator was sqeezing perforations in anticipation of additional tests.

Mulkey Succeeds Wirshing at Waukesha

The Waukesha Motor Co. announces the resignation of their Pacific Coast manager, Herbert Wirshing, who has been in charge of their Pacific Coast

A. G. Mulkey

business since direct branch operations were begun the Spring of 1932. A. G. Mulkey who was formerly associated with Mr. Wirshing at the Los Angeles branch, and more recently has managed the Seattle branch office succeeds Wirshing as Pacific Coast manager.

During Mr. Wirshing's long administration the branch activities had expanded to such an extent that a new building combining warehouse and offices was erected in 1941 at 4927 Pacific Boulevard, Los Angeles, where nearly eight thousand square feet of space has been devoted to show room, offices, warehouse and service shops.

Mr. Mulkey's connection with the Waukesha Motor Co. is a matter of some 20 years standing preceded by specialized training in internal combustion engines combined with service and sales experience with the Ford Motor Co. His wide knowledge of Waukesha products and Waukesha policies is the result of some ten years of factory training including every branch in the manufacture, test, and servicing of Waukesha engines. His many acquaintances and friends on the Pacific Coast join in congratulations.

Philip Hauck Made Texaco Purchasing Agent

Philip Hauck, assistant divisional purchasing agent of The Texas Co., has been appointed divisional purchasing

Philip Hauck

agent of the company for the Pacific Coast Division, with headquarters in Los Angeles. He succeeds C. W. Chandler who has been retired because of illness after thirty-two years of service with the company.

Mr. Hauck entered the service of the California Petroleum Corp in 1923 as a clerk in the accounting department. Shortly after the California Petroleum Corp. became The Texas Co. in 1928, he was transferred to the purchasing department as price clerk. He was made assistant divisional purchasing agent in March 1940.

Buy Defense Bonds

Coastal District

Century Oil Tests Shallow Core Hole

Seeking shallow tar production on the Hall property at Carpinteria, Century Oil Co. of Long Beach is preparing to make a test of its Core Hole No. 1. Drilled to 715 ft., the well encountered heavy oil sand at 623 ft. which continued in streaks to 703 ft. where Temblor shale was entered. A 4¾ in. combination string is being run to 693 ft. which will be cemented at the top of a 90 ft. perforated interval. Located in sec. 34,4n-25w, the well is not far from Continental Oil Co.'s relatively deep test which showed heavy gas pressure when drilled more than a decade ago.

San Miguelito Well Flows 1000 Bbl. Rate

Grubb No. 24, Continental Oil Co.'s latest completion at San Miguelito, was brought in during the latter part of January flowing at the initial rate of 1000 bbls. a day of 33 gravity oil and 5,262,000 cu. ft. of gas through 48/64 in. bean. The hole was bottomed at 7110 ft. and was completed with 7 in. casing cemented at 5777 ft. No further development plans have been announced by the company.

Deep Wells Complete At Ventura Avenue

Two deep wells are being completed in the Ventura Avenue field, one each by Shell Oil Co., Inc. and Tide Water Associated Oil Co. Shell's effort is Shell-Lloyd No. A-1 which is testing after landing a combination liner on bottom at 11,516 ft. and cementing through perforations at 10,823 ft. while the Tide Water project is McGonigle No. 18 which is bottomed at 11,350 ft. Both are located on the north flank of the field. Only other active wells are Shell's Edison No. 39 and Taylor No. 153, Tide Water Associated Oil Co.'s V.L. & W. No. 55 and Hartmann No. 31 and Alliance Petroleum's Hisey No. 5.

Bel-Air Completes 2nd Twitchell Well

With bottom at 5361 ft. and 7 in. casing cemented through perforations at 4815 ft., Bel-Air Oil Co. completed Twitchell No. 2 on the south flank of the Santa Maria Valley field at the estimated initial rate of 2000 bbls. a day flowing through the pump. After 5 days, production had settled to 1400 bbls. of 14 gravity oil cutting less than 1.0 percent. The Twitchell lease is located in sec. 35,10n-34w.

Two other wells were finished in the past fortnight, R. R. Bush Oil Co. and Hancock Oil Co. bringing in Wylie No. 4 for 675 bbls. in sec. 25 and Pacific Western Oil Co. completing Hobbs No. 9 at a 310 bbl. rate.

Next well to go on production is the Burgdoff project in sec. 26 which will produce the interval from 4810 to 5000 ft. Only active driller is Union Oil Co.'s Union Sugar No. 13 which is fishing for drill pipe stuck at 5150 ft.

Lack of transportation facilities is holding total field production to about 7000 bbls. a day which is but little over half the quota allocated for the month of January. Should the transportation problem be solved, it is probable that more drilling will be done at Santa Maria as conditions are such that a few wells can be drilled under the forty acre rule.

COASTAL COUNTIES WILDCATS

Area	Well	No.	Section	Depth	Status
	Santa Barbara County				
Cat Canyon	Alphonzo E. Bell Corp., Gilmore	1	23, 9-33	6377	Idle
	O. C. Field & Wm. C. McDuffie et. al. Palmer-Stendel	13-1	13, 9-33		Rig
Carpinteria	Century Oil Co., C. H. Hall	1	34, 4-25	715	Drilling
Casmalia	Dolly Adams Oil Co., Morganti	2	13, 9-35	1700	Prep. to pump
	O. C. Field Gas. Corp., Righetti	2	13, 9-35	2195	No report
Lompoc	Alhponzo E. Bell Corp., Lompoc	6	28, 8-34		Graded roads
	Fickert Oil Co., Ltd., Well	1	8, 7-33		Rig
Santa Maria	John W. Lee, Trustee, T.G.	1	33, 10-33	3503	Idle
	Ventura County				
Bardsdale	Hopland Oil Co., Well	1	1, 3-19	4634	Idle
	Ventura Southern Oil Co.	G-1	19, 3-19	1280	Drilling
Conejo	Sycamore Oil Co., Boylan	1	23, 1-20	1700	Idle
Ojai	Coates, Spencer D., Pirie	5	7, 4-22	145	Drilling
	Kelalee Pet. Co., Harvey	1	8, 4-21		Rig
	Richfield Oil Corp., Ojai	44	13, 4-22	4843	Drilling
Piru	Delroy Pet. Corp., Fisk Core Hole	1	22, 5-18	40	Drilling
	Pacific Western Oil Co., Temescal	11	4, 4-18		Rigging up
Sespe	Alford Drlg. & Expl. Co., Goodenough	1	18, 4-19	2581	Re-rigging
	Ivers, H. A., Kentuck	13½	1, 4-20	1135	Rng. casing
Timber Canyon	Denison, A. T., Denison	1	13, 4-21	885	Drilling
	Crude Oils, Inc., West	1	19, 4-20	958	Idle
	Henderson-Ortez Oil Co., O'Leary	1	29, 4-20		Rig

NORTHERN COUNTIES WILDCATS

County	Well	No.	Section	Depth	Status
Colusa	Pacific National Pet. Corp.	1	17, 17n-4w	1400	Drilling
Contra Costa	Faria, Joseph Jr., Faria	1	22, 2n-1w		Location
Madera	Blake, T. E., Chuck	1	28, 10s-17e		Rig
	Shell Oil Co., Inc., Chowchilla Farms	6-18	18, 10s-14e	2723	Testing
Monterey	Loma Grande Oil Co., Corey	1	23, 24s-10e	4004	Drilling
San Joaquin	Westates Pet. Corp., Spence	1	22, 1s-73		Location
	Standard Oil Co., West Coast Life	2	4, 1n-5e	1855	Drilling
	Standard Oil Co., Blewett Comm.	3	23, 3s-6e		Rig
Sutter	Buttes Oilfields, Inc., Buttes	7	3, 15n-1e	5010	Idle
	Buttes Oilfields, Inc., Buttes	8	28, 16n-2e	5300	Drilling
Yuba	Wright, L. G., Cox	1	18, 14n-5e	1805	Redrld. 1722 —Idle

Allocation Difficulties With Washington

Loom for California Operators

It is becoming increasingly evident that the preponderance of California operators and Petroleum Coordinator Harold L. Ickes do not quite see eye-to-eye in the complex matter of allocating crude oil production in this state. The only certainty which indicates the outcome of this clash of opinion is the fact that the Petroleum Coordinator's actions are inspired solely by patriotic considerations. When all California operators fully realize that our country is at war and that no price is to great to pay for victory, we can be sure that production schedules submitted to Washington will be approved with commendation.

Petroleum Coordinator Ickes has asked for increased production of heavy oils. The Petroleum Coordinator sees in heavy oils the source of much needed fuel oil, and, in spite of the relatively small recovery of light ends, a source of high octane fractions supported by production of rich gas.

Petroleum Coordinator Ickes directed that the maximum consideration be given to "stripper wells." Operators who fail to realize how deeply ingrained are the principles of conservation in the Petroleum Coordinator have many baffling days ahead. Those oilmen who heard Secretary of the Interior Harold L. Ickes talk at the Diamond Jubilee of Oil in Titusville, Penn'a, in 1934, know here in 1942 that Petroleum Coordinator Ickes has decidedly definite ideas on conservation, and that maintenance of stripper wells on production loom importantly in his view.

Elimination of certain veteran pumper fields from the "stripper well" category, such as Signal Hill, Santa Fe Springs and Old Huntington Beach, leaves a total of 12,000 so-called stripper wells. These wells produce less than 30 barrels of crude oil per day. Of these, 4000 produce up to a maximum of 4 barrels per day. Another 3281 of these wells produce from 5 to 9 barrels per day. Two thousand of these wells have an output of from 10 to 14 barrels per day, and 1300 of these wells will produce from 15 to 19 barrels per day. One thousand of these wells produce from 20 to 24 barrels per day, and 700 will produce from 24 barrels to 29 barrels per day. These 12,000 stripper wells have a total production capacity of 102,000 barrels per day.

This is considerably at variance with earlier announced figures which would have indicated that somewhat more than half of the state's allowable would be produced by wells in the stripper well class.

A controlling factor in allocations, necessarily, is the matter of transportation facilities. It would serve no useful purpose here to point out certain difficulties which have arisen in certain areas. If a translation of barrels of crude oil production into terms of tons of steel appears on the favorable side, we can be certain that some means will be developed to move crude oil which is temporarily without adequate outlet. A considerable drain on the volume of steel available to the petroleum industry is promised in two pipeline projects proposed for the east. The Director of Defense Transportation has received a request from the Trans-American Pipe Line Corp., for a recommendation by the Director that a Presidential Proclamation be issued that the construction of a crude oil pipe line from a point in Texas to Savannah, Ga., is or may be necessary for national defense purposes, under the provisions of the Cole Pipe Line Act approved July 30, 1941. The statement issued by the office of Defense Transportation follows:

"In order to obtain a clear understanding of all circumstances relating to the construction of the proposed pipe line and a determination of its necessity for national defense purposes, it seems desirable to assign this subject for hearing before a Board, which is hereby created, composed of B. H. Meyer, C. E. Childe, and J. Paul Kelley.

"This proceeding is hereby assigned for hearing before the Board at 10 o'clock a.m. on February 19, 1942, at the office of the Inter-State Commerce Commission, in Washington, D.C., at which time an opportunity will be afforded all interested to be heard."

Another proposed crude oil pipe line, sought by National Defense Pipe Lines, Inc., would extend from a point in Texas to Bayonne, N. J., a distance of 1570 miles. Application for priorities for the construction of this line was turned down last fall by the old Supply Priorities and Allocations Board. At that time Petroleum Coordinator Ickes, as well as officials of the Army and Navy, warned that if this country actually became engaged in the war it would be extremely difficult to keep the east supplied by tanker up the Atlantic Seaboard. The Petroleum Coordinator said that had the pipe line, as authorized by Congress, been started, it would now be operating as far as Illinois.

The immediate undertaking by the petroleum industry of a steel salvage and equipment rehabilitation program has been requested by the Coordinator. Pointing out that there is urgent need for scrap iron and steel to meet requirements of the war effort, he said that literally thousands of tons of scrap could be assembled by the petroleum industry and turned back into the channels of trade. "Every producer, every refiner, and, in fact, every person engaged in the industry, regardless of his position, should make it his patriotic duty immediately to bring to commercial channels the maximum possible tonnage

of scrap which is not, and cannot be employed by the oil industry," the Coordinator said. Outlining the scope of the program, Deputy Coordinator Davies said it probably would range all the way from the rather simple operation of gathering scrap to the extreme of digging up unused pipe lines and cutting up obsolete refining units.

What effect the recent sharp increase in tanker sinkings along the Atlantic Coast will have on the projected transfer of 40 tankers from service in the east to the Pacific Coast, remains to be seen. On Feb. 7, the Petroleum Coordinator said that crude oil stocks are dwindling rapidly in the east because of the sinkings and transfers of tankers to war service. He called upon the petroleum industry to pool its products to meet war and essential civilian requirements in the Atlantic Seaboard states. Deputy Coordinator Davies said that the pooling action was taken at the request of the industry. He signed an order authorizing the appointment of a 16-member industry committee of supplies and distribution in 17 eastern states and the District of Columbia.

At the same time the Petroleum Coordinator announced that movement of petroleum by rail tank cars to the east set a new record in the week ending January 31. Tank car movements in the week totaled 5125, equivalent to a daily delivery rate of 164,700 barrels, or 10 per cent of the daily demand.

The Conservation Committee of California Oil Producers has approved a new method of allocating production to the various fields and pools of the state for February, submitted by the allocation subcommittee pursuant to instructions of the Conservation Committee late last month.

The new method, which sets up preliminary quotas subject to modification caused by special conditions such as requirement for particular types of oil, disruption of transportation, or other war-caused factors, is based upon the determination of a calculated minimum rate of production, compared with the maximum efficient rate of production previously determined, the difference in the two figures then being modified by the application of a power factor and a percentage figure to arrive at the preliminary quota.

The method of allocation also makes a determination of pools and fields exempt from curtailment. Exempt fields are those whose preliminary primary quota as calculated is within 10% of the maximum efficient rate of production, except that in such fields no well will have an allotment of more than 75 barrels per day. This latter qualification, which applies to wells in exempt fields only, is intended to prevent too high levels of production from the occasional exceptional well in a pool whose average production from all wells is in the lower brackets. It is estimated that under this method, 86 pools in the state will be exempt from restrictions on production, unless such restrictions are made necessary by war factors.

One effect of the new method, if it is approved by the Petroleum Coordinator, will be to increase the allotment to producers of heavy oil, since the minimum allotment is based upon the two factors of depth and gravity of oil produced, and as the wells go down in the gravity scale, the allotment tends to be increased.

(Continued from Page 5)

Federal Loan Agency on the Standard Oil Co. of N. J. and Magnolia contracts:

"Jesse Jones, Federal Loan Administrator, announced today that, upon the recommendation of the Secretaries of War and Navy and the Petroleum Coordinator, Defense Supplies Corp., had contracted with the Standard Oil Company of New Jersey for the purchase of all 100 octane aviation gasoline produced by it and its suppliers.

"The contract contemplates that the company will increase its production of 100 octane aviation gasoline from 16,000 barrels a day, which is its present capacity, to 37,000 barrels per day. Additional plant facilities for this increased production will cost the company approximately $50,000,000, of which Defense Supplies Corp. will advance $14,400,000 to be repaid in gasoline. The purchase contract runs for three years after the new facilities are completed with an option by Defense Supplies Corp. to extend it for two additional years. The price of the gasoline will be 13c per gallon for the first year and 12c per gallon thereafter.

"Defense Supplies Corp. has also agreed with Magnolia Petroleum Co. to purchase its entire production of 100 octane aviation gasoline which at present is 3,000 barrels per day, and which is to be increased to 12,000 barrels per day. New plant facilities for this increased production will cost Magnolia Petroleum Co. approximately $15,000,000. Defense Supplies Corp. will advance the company $4,500,000 to be repaid in gasoline. The contract is for 3 years after completion of the facilities with an option for Defense Supplies Corp. to renew for an additional two years. The price to be paid for the gasoline under the contract is 13c per gallon.

"A contract has also been made with the Cities Service Co. for the production of 1,300 barrels of 100 octane aviation gasoline per day.

"These contracts will increase the daily output of aviation high octane gasoline to approximately 71,300 barrels. Other contracts are in course of negotiation to bring the daily output to 150,000 barrels."

Action has been taken to carry out the orderly marketing of automobiles and light trucks under the OPA rationing plan, and to step up production of octane aviation gasoline, according to Washington advices.

Jesse Jones, Federal Loan Administrator, announced that the RFC has set aside $100,000,000 to assist authorized dealers, finance companies and banks, in the carrying and

orderly marketing of automobiles and light trucks manufactured subsequent to January 16, 1942, to be disposed of under the rationing plan of OPA.

Jones also announced that Defense Supplies Corp. had entered into three contracts with The Texas Co. for the purchase of all 100 octane aviation gasoline produced at the refineries of The Texas Co. located at Port Arthur, Texas, Los Angeles, California, and Lockport, Illinois.

These contracts contemplate that the company will increase its production of 100 octane aviation gasoline from 4050 barrels per day, which is its present capacity, to 9510 barrels per day. Additional plant facilities for this increased production will cost the company approximately $11,500,000, of which Defense Supplies Corp. will advance $8,500,000, as a loan. The purchase contracts run for three years after the new facilities are completed with an option by Defense Supplies Corp. to extend them for two additional years.

The average price of the gasoline is slightly in excess of 13½c per gallon.

Germany's Supply Position

The position of Germany with regard to production and supply of mineral raw materials vital to war purposes, resulting from an 8-year mobilization of resources through purchase and aggression, as well as internal effort, is reviewed by the Foreign Minerals Division of the Bureau of Mines in a report submitted to Secretary of the Interior Harold L. Ickes.

The report, recently prepared in accordance with the Bureau's long established function of reporting on production, trade and consumption of minerals in foreign countries as well as in the United States, points out that Germany within her own borders and through the development of resources in allied countries and in lands which she has occupied, "is surprisingly well supplied with minerals for essential military needs." While the report deals with the mobilization of natural resources of Germany and its victims rather than that of the democracies, **it emphasizes the tasks confronting the United States.**

In the case of aluminum and magnesium, the metals so essential to the manufacture of airplanes and incendiary bombs, Germany was out-producing the United States, Great Britain and Canada up to 1941. By the end of 1941, it was expected that the combined aluminum output of the three allied countries would pull ahead of German-dominated nations, and that the Allies' 1941 figures would be nearly doubled by the end of 1942. In the case of magnesium, it is believed that American and British output is now equal to German production, while American output alone by 1943 will be more than four times Germany's expanded 1941 production.

Germany is assured ample supplies of lead, zinc, and mercury for all essential needs, and now controls enormous resources of iron ore, manganese, and coal capable of supporting an iron and steel industry that can compete with that of Great Britain and the United States. Blast furnaces now within the German sphere of domination produced 44 percent of the world's pig iron in 1940, and the Axis is diverting a larger proportion of its steel to military needs than are the democracies. Germany also has available large reserves of regimented labor, and if she is successful in controlling the areas now occupied and in reorganizing industry and transportation to meet military requirements, she should be able to wage war effectively for some time.

Germany lacks copper, tin, tungsten, nickel and petroleum but these deficiencies have been made up in part by substitutions, reclamation, stock-piling, and increased production mostly from submarginal deposits. There is no immediate prospect of a collapse of the military machine because of shortages of any of these minerals. German possession of the Near Eastern oil fields, would assure ample petroleum for all essential needs if transport and reconstruction problems were solved.

The Bureau of Mines report by Charles Will Wright, Foreign Minerals Specialist, follows:

When one sums up the annual output of minerals, metals, and fuels since 1932 in Germany, and adds to these figures the output of the areas acquired by Germany during the last two years, the results indicate that Germany today is surprisingly well supplied with minerals for essential military needs. In some instances, such as bauxite, aluminum, and magnesium, recent production has been greater than the combined output of the United States, Great Britain, and Canada but Germany lacks certain essential minerals such as tungsten, tin, copper, molybdenum, asbestos, and particularly petroleum. However, as Germany has been preparing for the present war since 1933, large quantities of these latter minerals were bought and stockpiled. (See Table 1.) She realized from the start that to be powerful, a nation must secure the required minerals and metals either by increase in production from domestic sources, by purchase, or aggression. Germany has utilized all three of these methods to a marked degree.

From 1935 to 1939 the writer made a general survey in each of the European countries and reports on their mineral resources and output were issued by the Bureau of Mines. It is to bring these data up to date and to give a general picture of the mineral situation within the New Germany that the present summary has been prepared.

Handicapped by a deficiency of raw minerals that could be profitably mined, Germany first proceeded to develop low-grade deposits of iron and copper, and built up her mineral production regardless of cost. Examples of this are the pig iron production at the Herman Goering Works near Salzgitter, and the increased production of copper at the Mansfield mines at a cost estimated to be over double the world price. Since 1933 Germany has bartered with the Balkan States for more of their mineral output and built up large stocks by imports from the Western Hemisphere. The large increases in mineral imports since 1933 demonstrate that Germany began preparations for the present war some 8 years ago. Germany's greatest increase in mineral supply, however, has been through the occupation first of Poland, then Norway, then France, the Balkans, and later of the Ukraine and Donetz Basin. Reports indicate that no time is being lost by the Germans in these occupied countries in organizing mineral production in order to get the utmost benefit out of these new sources of supply.

There is a general belief in the United States that with our great mineral resources and plant capacities, it is only a matter of time when we, together with Great Britain, will have control of the air and sea. While this is true, it should be remembered that the New Germany already is a powerful adversary working at maximum capacity in the output of airplanes, submarines, tanks, and munitions. Just when the United States and Great Britain will be in position to exceed the German production of these war machines depends largely on their ability to increase and maintain mineral

production and the extent to which civilian consumption is curtailed to permit more rapid advances in the manufacture of required war materials. Substantial progress along this line has been made since December 7 but a large part of our mineral production is still consumed for non-defense purposes.

Another factor assisting Germany's war effort is the regimentation of labor and industry. As early as 1936 all labor unions had been placed under Government control and labor was working 60 hours a week. Those who obstructed the Reich's labor program were sent to concentration camps. In 1939 when the writer last visited Germany, food rations for the working man and his family were a controlling factor against any agitation or inefficiency of output. During the last decade Germany has built up efficient management in all branches of her industries with full control over supplies and labor. Research laboratories are turning out improved weapons and their technicians and engineers are making the most of the mineral resources in the occupied areas. Besides the temporary advantage of regimented industry oriented solely to war objectives, Germany has another great advantage over her adversaries in her ability to deliver tanks, ammunition, and airplanes to the actual fighting lines in greater quantity by reason of direct and comprehensive transport facilities and at much less risk.

Summary of Germany's Mineral Supply Situation—Fuels

Coal.—Coal output in German-controlled areas is about one-half of the world's production or more than sufficient for all purposes, particularly in the manufacture of coke for use in blast furnaces. Because of the proximity of the major coal fields to the iron-ore deposits and the well developed transportation facilities available, Germany is in an excellent position to make good use of her large coal supply. Control of the Donetz coal fields in Russia, together with the iron mines and steel plants of the Ukraine, if held, would place her in a still stronger position. Coal and lignite are also used extensively in Germany in the manufacture of synthetic petroleum products.

Petroleum[1].—The area now controlled or dominated by Germany consumed approximately 221 million barrels of petroleum products in 1938, and produced about 78 million barrels (chiefly in Rumania) or 35 percent of its requirements in that year. Germany has adopted extreme measures to meet the shortage resulting from th British blockade. As early as 1938 she was producing 14,000,000 barrels of synthetic petroleum products from coal, of which Germany has very large reserves. Her collapse due to failure of oil supplies thus cannot be forecast with assurance at this time.

Western and central Europe has always been primarily a coal-burning area; fuel oil has been consumed chiefly by the merchant marine, the national navies, and the petroleum industry. The British blockade has virtually swept the merchant marine of continental Europe from the high seas. Naval requirements under present conditions are relatively small. Likewise consumption of fuel oil in the oil fields and in the refineries has always been relatively low. Civilian consumption of gasoline has been cut to the bone. However, the most serious industrial problem probably is the supply of lubricating oils. But Germany has pioneered in reclaiming and re-using lubricating oils, and to some extent animal and vegetable oils have been used to replace mineral lubricants.

In addition Germany probably built up substantial stocks prior to the outbreak of war. The 221 million barrels of indicated petroleum consumption in the European and Mediterranean area now controlled by Germany undoubtedly included considerable accumulation of stocks, particularly in Germany where the indicated German demand for mineral oils rose rapidly from 24 million barrels in 1933 to 53 million barrels in 1938. In the recent pre-war years nearly every European country was requiring the importing and refining companies to maintain from three to six months' supply of mineral oils on hand at all times. The rapid conquest of France, Belgium, the Netherlands, and Scandinavia placed in German hands an unknown but considerable amount of refined oils which had been accumulated under the self-sufficiency programs of these countries.

[1] Notes on Petroleum prepared by A. H. Redfield, Economic Analyst, Bureau of Mines.

Taking everything into consideration the German petroleum problem appears to be largely one of rationing and administration. With 78 million barrels or more of petroleum and petroleum substitutes at its disposal, and military needs essential industrial needs given preference, Germany appears to be in no immediate danger of the failure of her military machine for lack of gasoline and lubricants.

The occupation of the Near Eastern oil fields by Germany, which is still a possibility, would add to her current supply a potential production of 192 million barrels annually, or more than sufficient for all civilian and military needs. But the lack of facilities to transport this oil overland to Germany might deprive her of any real advantage of such occupation for some years. Any destruction wrought by the retiring troops, if they were forced to retreat, would be a further handicap to Germany in the exploitation of these oil fields even though permanent destruction of this oil supply cannot be accomplished.

TABLE 1—GERMAN IMPORTS OF CERTAIN STRATEGIC MINERALS 1932 to 1939,(1) in Metric Tons

	1932	1933	1934	1935	1936	1937	1938	1939 (6 Mos.)
Tungsten ore	1,615	3,614	4,385	7,681	8,726	11,372	14,200	5,731
Tungsten metal and scrap (incl. chromium and cadmium)	630	1,317	2,877	1,611	4,114	6,605	7,590	4,930
Nickel ore	17,694	34,513	37,609	29,013	17,651	19,990	34,215	15,800
Nickel metal	565	1,968	4,060	5,929	3,392	3,365	3,984	2,164
Chromium ore	42,128	47,370	76,983	95,440	123,375	132,162	176,406	110,131
Copper ore	237,878	240,902	324,921	400,538	482,471	555,577	653,931	336,523
Copper metal	138,100	154,000	182,200	153,365	127,549	169.920	272,400	89,355
Copper scrap	17,527	17,911	14,039	19,891	24,372	32,703	27,308	12,107
Manganese ore	107,000	132,000	223,000	394,256	229,634	554,170	425,785	153,757
Molybdenum) Uranium) Titanium) Vanadium ores)	2,848	8,945	20,595	27,359	34,512	41,861	64,179	21,365
Tin Ore	1,858	431	602	1,232	1,563	6,623	6,142	2,634
Tin & Tin Alloys	9,038	11,281	13,470	11,824	9,176	10,320	12,090	4,768

(1) Statistics from "Monatliche Nachweise uber den auswartigen Handel Deutschlands", Berlin.

S. F. Oil Executive To Government Position

Washington, Feb. 9. — James MacPherson, San Francisco, today was appointed deputy director assigned to the procurement division of the Treasury Department handling Lend-Lease purchases and assisting in co-ordinating non-military purchases of government agencies, it was announced by Douglas C. MacKeachie, director of purchases, he will also be a member

of WPB's procurement policy committee.

Mr. MacPherson has been with WPB and its predecessor, OPM, since June of 1941, in charge of the equipment and supplies procurement advisory branch of purchases division.

Mr. MacPherson had 20 years experience in purchasing and organizing for the petroleum, ice and cold storage business. He started with Standard Oil of California in 1919 and held various positions with it and subsidiary companies. He resigned in 1940 to become secretary-treasurer of the California Arabian Standard Oil Co., from which position he is now on leave.

K. C. Tomlinson Made Reliance Regulator V. P.

K. C. Tomlinson has been appointed vice president of the Reliance Regulator Corp., succeeding A. C. Thompson, who died early in January. J. J. Delaney, formerly sales manager, has been made general manager.

Development Reviewed In Northern Districts

In sec. 6,3n-3e of the Rio Vista gas field, The Texas Co. completed Welch No. 2 at 4305 ft. flowing 11,000,000 cu. ft. of dry gas through a 48/64 in. bean. After blowing itself clean the well was shut in with pressures equalizing at 1700 lbs. In sec. 2,3n-2e, Standard Oil Co. is endeavoring to pull the liner from Anderson No. 4 after making an unsuccessful attempt with bottom at 4370 ft.

At Marysville Buttes, Buttes Oilfields, Inc. tested Buttes No. 7 in the interval 4920-5010 ft. but is reported to have recovered only a little gas. Two miles to the northwest in sec. 28,16n-2e, the company is drilling Buttes No. 8 in hard Cretaceous shale below 5300 ft.

In sec. 4,1n-4e, Standard Oil Co. is drilling West Coast Life No. 2-1 in the McDonald Island gas field. Last reported depth was 2000 ft.

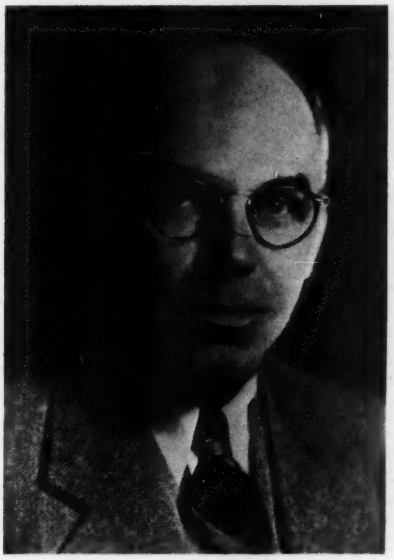
Shell Oil Co. is making a production test in Chowchilla Farms No. 6-18, sec. 18,10s-14e, after bottoming at 2723 ft. and cementing casing at 2610 ft.

The most northerly active well in the state is Pacific National Petroleum Co.'s No. 1 at Sites in Colusa county. Located in sec. 17,17n-4w, the well is reported as attempting to kill a heavy water flow at 1400 ft. Some gas has also been encountered by this project.

Loma Grande Oil Co.'s Corey No. 1, located near Bradley in Monterey county, was deepened to 4004 ft. where an electric log was being run at last reports.

Seaside Oil Co. Elects Chief Officers

At a special meeting of the board of directors of the Seaside Oil Co., Santa Barbara, H. B. Kellogg was elected president and general manager of the



H. B. Kellogg

company, and F. E. McClaren, vice-president and sales manager.

Mr. Kellogg succeeds to the office vacated by the recent death of M. W. O'Brien. He has been vice-president ot the Seaside Oil Co. since September 1936, and a director since February 1937.

Mr. McClaren's election to the vice-presidency of the Seaside Oil Co. climaxes a spectacular rise with the company. Entering the organization as asasistant sales manager in July 1936, he was made sales manager in February 1937. In November of the same year, he was made a director. Following a policy of conservative yet progressive expansion, the Seaside Oil Co., under the guidance of Mr. Kellogg and Mr. McClaren, has risen to a position of major importance in the gasoline industry in

F. E. McClaren

California and Arizona. Notable achievements have been the spread of the company's operations into the San Joaquin and Sacramento Valleys and the inauguration of a station modernizing program. This latter effort coincided with the acquisition of new locations and produced within a five-year period a chain of distinctive, modern stations throughout California and Arizona.

Standard Finishes Los Flores No. 4

Producing more than 500 bbls. a day on agitated flow, Standard Oil Co. brought in Los Flores No. 4 from the Miocene Chert Zone at West Cat Canyon. The hole was carried to 6144 ft. where 7 in. casing was landed and cemented through perforations at 5757 ft. In the same section, 27, 9n-33w, Union Oil Co. is preparing to complete Bell No. 13 at 6050 ft. and is grading location for Bell No. 14.

Engineering, Technology, latest news—twice a month in California Oil World.

A survey gathered data to show that 50,000 girls have recently returned to cotton top hose. When at its height, this investigation must have been interesting.

Ben C. Dumm Joins Allied Supply Co.

Allied Supply Co. announce that Ben C. Dumm has been added to their staff to handle National Transit Pump and Engines account.

Ben C. Dumm

This field of endeavor is neither new nor strange to Ben since he represented National Transit products in this territory for several years, and has just completed seventeen years service with Cooper-Bessemer Corp., who are manufacturers of Diesel, Gas Engines and Compressors, serving as Asst. Dist. Manager

It is felt this additional asset to Allied Supply Co. organization is another gesture to provide their customers and friends greater service when called upon for data pertaining to pneumatic or hydraulic engineering.

We feel sure that Allied Supply Co.'s and Ben's friends will be pleased to learn of this added service department to a rapidly growing organization.

M. O. Johnston to Sell Soll Core Barrel

M. O. Johnston Oil Field Service Corp., manufacturer of the Johnston Formation Tester, has announced that, effective Feb. 1, 1942, sales and service for the Soll Core Barrel will be handled exclusively by that firm. The Barrel was formerly distributed through the Soll Core Barrel Co. of Compton, Calif., who will continue the manufacture of this equipment for distribution by Johnston. All equipment in service will remain the property of the Soll Co. Sales and service will be through all Johnston district offices in California, including—in addition to the main Los Angeles Office—branches at Bakersfield, Ventura and Santa Maria. Exclusive export rights for the Soll Core Barrel were previously acquired by the M. O. Johnston Co.

The Soll Core Barrel is well known to California oil operators. For many years both the conventional and wire line types have established enviable records for core recovery. An important reason for this recovery record is found in the exclusive Soll feature of a telescoping receiving barrel, which permits continued entry of core even though preceding core material may stick in the barrel during operations, according to the makers.

Distribution of the Soll Core Barrel is a desirable supplement of the world-famous Johnston Formation Testing Equipment, since formation tests are made following the coring of sands which may have production possibilities. This will enable Johnston to render an even more complete service for California operators than in the past.

Full information concerning the Soll Core Barrel may be obtained by writing direct to M. O. Johnston Oil Field Service Corp., 3117 San Fernando Road, Los Angeles.

New Radio Hours For "Swing Shifters"

Time Magazine and the Los Angeles Chamber of Commerce joined hands recently to laud the revolutionary new program offered by KNX to meet the needs of defense workers.

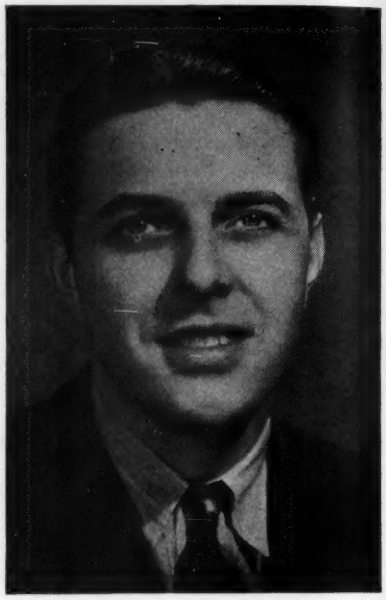
Hundreds of thousands of workers have had their daily routine turned upside down; going to work at 4 in the afternoon, and finishing at midnight, leaving them without their customary radio fare. Here is what Time says:

"In Los Angeles a CBS program director shot into the office of a vice-president one morning with a new idea. A few nights later CBS' local outlet, KNX, announced at 1:15 a.m. that instead of signing off it was inaugurating a regular four-hour program lasting to 5 a.m. for the benefit of "swing shifters" in local war industries."

C. B. Tibbets, president of the Los Angeles Chamber of Commerce, has endorsed the series in a letter to KNX which stated, "Entertainment is a tremendous factor in keeping up the morale of our people, and your action in making these programs available to those many people whose working hours are now so arranged that they must get their recreation while most of us are sleeping is just another way to help "Keep 'Em Flying!"

White Transfers Tommy Parramore

T. H. (Tommy) Parramore, zone service manager for the White Motor Co. in charge of Pacific Coast service, has been temporarily transferred to the White



George W. Layfield

Factory Service Department in Cleveland. Mr. Parramore will be on special detail coordinating parts and service problems brought about by White's huge war production program. Mr. Parramore is well known wherever Whites are sold on the Pacific Coast. He has been in various executive service jobs on the Coast for the past twenty years.

W. D. Patterson, regional manager for the Pacific Coast, also announces the appointment of George W. (Bud) Layfield as Los Angeles branch service manager. Mr. Layfield comes up to his new assignment after fifteen years with the Los Angeles branch. For the past four years he has served as Los Angeles superintendent of the White Shop which is one of the largest and most complete truck service plants in the West.

O. E. "Dusty" Dustman Dies Suddenly in L. A.

A heart attack Feb. 3 proved fatal to O. E. "Dusty" Dustman, 56, district manager of the Brodie Meter Co. Funeral services were held in Los Angeles.

Engineering, Technology, latest news—twice a month in California Oil World.

THIS LAUGH OFF!!

A group of British were touring Moscow. The Russians were taking them about, showing the sights. "This," they said, pointing to an impressive highway, "is Anthony Eden boulevard, formerly Goering road"; and again, pointing to an impressive edifice, "That is the Winston Churchill building, formerly Adolf Hitler palace."

So, the British, deeply impressed, took leave of their hosts, and, in departing, said: "Farewell, comrades, formerly So and sos."

A woman riding on a trolley car was anxious not to pass her destination.

She poked the conductor with her umbrella.

"Is that the First National Bank?"

"No, mum," replied the conductor. "That's my stomach."

A woman got on the train with nine children, and when the conductor came for her tickets she said: "Now these three are 13 years old and pay full fare, but those three over there are only 6 years old, and these are 4½."

The conductor looked at her in astonishment. "Do you mean to tell me that you get three every time?" he asked.

"Oh, no," she said "sometimes we don't get any at all."

The absent-minded professor often found names and telephone numbers written in his notebook, but he couldn't recall the persons they represented. Recently he made a general checkup and came across one name which baffled him particularly, so he wrote the man a letter asking if he had ever heard of the professor and if the professor was supposed to do something for him.

The man who received the letter wrote back a very cordial reply, stating that the professor had already done something for him. He was the professor's wife's first husband.

He was watching a business man signing letters. "Don't you read your letters before signing them?" he asked in some astonishment.

"Letters?" exclaimed the business man in surprise as he paused in his rapid autographing. "I thought these were affidavits."

Then, there's the story of the traveling salesman who got caught in the storm and spent the night at a farmhouse. In the morning he stood at the second story window of the house watching the flood go by, carrying pieces of barns, chicken coops, limbs of trees, and so on. As he stood there, much to his amazement, he saw a straw hat come floating upstream, against the current. A few minutes later, down it came again. Shortly after that it floated up again. Thinking he was seeing things, he called the farmer's daughter. "Do you see what I see?" he asked. The girl looked at the hat and said: "Oh, that must be grandpa. He said he'd mow the lawn today in spite of hell or high water."

Liza: "Honey, is yo' goin' ta take me to Florida?"

Rastus: "I didn't say I'se goin' ta take you anywheres."

Liza: "Las night yo' tol me yo' was goin' ta take me to Florida."

Rastus: "Yo' sho got me all wrong, gal. What I said was that I was goin' ta tampa with yo' ".

"Look at that little midget across the street!"

"Yes. His father was a Scotchman."

WEIGHT INDICATOR POINTS
IN WILDCAT LOCATIONS where you want to know all the dope on formations you've never drilled before, the Martin-Decker Rate of Penetration Recorder is a valuable instrument. It does a whale of a lot more than just tell the rate at which your bit is digging! It charts every formation "break" . . . shows porosity of limestones . . . helps decide the coring program . . . serves as a valuable supplement to the electrical log.
And wherever you drill, the Rate of Penetration Recorder gives you an accurate check on efficiency that helps you get more out of bits and other items of drilling equipment. You can't beat it for accurate, completely automatic time-drilling-logging operations!
MARTIN-DECKER CORP., LONG BEACH, CALIF.

Business and Professional Directory

GERARD HENNY, Ph.D.

Consulting Geologist

417 S. Hill St. Los Angeles

VAndike 7053

W. T. WOODWARD

PETROLEUM ENGINEER — GEOLOGIST

TAFT, CALIFORNIA Phones:
Security Building Office 33 - Res. 295

EARL M. PRICE AND COMPANY

Established 1927

Blue Prints—Photostat Copies—Drafting Supplies—New Kern Co. Oil Maps

SPEED ★ CARE ★ QUALITY

TELEPHONE 77

1620 G Street, Bakersfield, California

R. S. MIESSE

OIL LANDS & OIL LEASES

1208 Subway Terminal Bldg
Los Angeles, California
Phone TUcker 7719

GRAYDON OLIVER

PETROLEUM ENGINEER

215 West 7th Street
Los Angeles, Calif. VAndike 3696

Read THE

CALIFORNIA OIL WORLD

"The Oil Man's Journal"

$1.00 a Year

MAPS

Large maps of Los Angeles Basin oil fields and map showing all California oil fields. Price $15.00 each on paper and $20 each on cloth. Individual state oil and gas maps of Mid-Continent and Rocky Mountain regions. Maps show geological cross sections at base. These maps indicate wells drilling, wells producing and abandoned, with depths.
All maps revised up to date of purchase.
JAMES C. BRANSFORD
1127 Story Bldg.
Los Angeles, Calif.
Phone: TUcker 7530

Classified Advertisements

CLASSIFIED ADVERTISING RATES

Small type: 50c per line per insertion. Count six words to a line. Minimum charge $2.00. All classified advertising payable in advance. Four consecutive insertions at price of three, if copy does not change.

24 times .....$ 7.50 per inch
1 time ..... 10.00 per inch

Not responsible for more than one incorrect insertion.

FOR SALE

No. 2500 Southwestern casing head plant. Complete unit 80 horsepower Bessemer compressor. J. Hokom Co., Phone HOllywood 3931. tf

FOR SALE

Franks portable coring rig. Derrick, drawworks, mud pump, all equipment completely portable, mounted on Ford V-8 Truck. Equipment, tires excellent condition. Box No. 50, care California Oil World. 2/5d

FOR SALE

Steel casing excellent condition.
3500 ft. 8⅝" 28# lapweld 10 thread Range 1.
1900 ft. 7" 26# lapweld 10 thread Range 1.
600 ft. 7" 26# liner 10 rows 250 mesh.
C. C. Killingsworth, 1226 Selby Ave., Westwood Village, L. A., Phone ARizona 3-2367 2/5b

FOR SALE

2 Complete steam drilling rigs incl. engines, pumps, 300-lb. and 350-lb. boilers, drawworks and all accessories. In excellent condition—capable drilling 15,000 ft.—also 8,025 ft. of 3½" and 14,000 ft. of 4½" Hydril drill pipe. See Ed. Bright, Room 540 Citizens Natl. Bank Bldg., Los Angeles, Phone MIchigan 4961. 3/20b

Los Angeles Nomads Elects 1942 Officers

The first regular meeting of the Los Angeles Nomad Chapter for 1942 was held at the Clark Hotel on January 14. The speaker of the evening was William Cross, Jr., son of the former managing director of the Socony-Vacuum Oil Co. Mr. Cross recently returned from England and gave an interesting and humorous account of his experiences and of the air-raid precautions now being taken in various parts of this country.

An honorary membership was conferred on Russ Havenstrite in a ceremony which was in keeping with Nomad tradition.

At the business meeting, held prior to the open session, officers for 1942 were elected. They are as follows: W. F. Bettis, president; E. M. Rees, vice-president; R. J. Eiche, secretary; J. C. Ballagh, assistant secretary; E. R. Smith, treasurer; D. B. Waite, assistant treasurer; Roland Smith, sergeant-at-arms; and T. Sutter and E. B. Fowks, Chapter regents.

A particularly large attendance of 83 men, including 54 members and 13 foreign guests, enjoyed the program of the evening.

The decision as to whether an Inaugural Ball, planned for sometime in February, would be held or not due to unsettled war conditions was postponed until a poll could be taken of all members. Questionnaire forms are now in the mail, although the preponderance of opinion at the meeting favored holding the Ball as originally scheduled.

Oil Men's Calendar

Calif. Natural Gasoline Association. Los Angeles Chapter—Meets 1st Thursday Each Month, Barker Bros. Bldg., Los Angeles—Dinner at 6:00 (Optional). Taft Chapter—Meets Third Thursday Each Month.

American Society of Mechanical Engineers—Los Angeles Section—Meets 2nd Thursday Each Month—Barker Bros. Bldg., Los Angeles. Dinner at 6:30 (Optional).

March

2-5—American Society for Testing Materials, Committe Week & Spring Meeting, Cleveland, Ohio.

10—AMERICAN PETROLEUM INSTITUTE, Division of Production, Pacific Coast District, Spring Meeting, Biltmore Hotel, Los Angeles, Calif.

23-25—American Society of Mechanical Engineers, Spring Meeting, Houston, Tex.

23-25—Western Petroleum Refiners Assn., 30th Annual Meeting, St. Charles Hotel, New Orleans, La.

26-27—AMERICAN PETROLEUM INSTITUTE, Division of Production, Mid-Continent District, Spring Meeting, Mayo Hotel, Tulsa, Okla.

15-17—American Institute of Mining & Metallurgical Engineers, Cincinnati, Ohio.

16-17—National Petroleum Assn., 39th Semi-Annual Meeting, Hotel Cleveland, Cleveland, Ohio.

21-24—American Association of Petroleum Geologists, 27th Annual Meeting, Cosmopolitan Hotel, Denver, Colo.